FLIGHT
and
AIRCRAFT ENGINEER

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The Outlook

Bad-weather Safety

IN an effort to reply to the various criticisms which have been made concerning the radio and air traffic control facilities at the London airfields, the Ministry of Civil Aviation has issued a statement which hardly, we feel, provides an adequate answer. This statement is printed elsewhere in the issue.

There is no doubt that the London airfields are adequately equipped by pre-war standards, but to say, as the Ministry does, that "no practice which is not compatible with the utmost possible safety is tolerated" is to make a somewhat negative contribution to the solution of the problem. Of course the aids are reliable within their limitations; the complaints are that no new efforts had been made and that there appears to be little attempt to use equipment already available.

In the statement the Ministry says that wartime radar requires a great deal of development before it can be applied to airline operations. This may be partly true, but it is a fact that the Ground Controlled Approach system, for instance, already provides a plan-position picture which can be used for air traffic control and, furthermore, this system only requires, from the aircraft using it, normal two-way R/T communication. No further development of this particular system is required to offer a safety factor much higher than that at present possible in the London area. Moreover, no long-term policy would be jeopardized by its use.

The list of radio and radar facilities which accompanies the Ministry's statement may at first appear to be impressive, but the items mentioned are either those which were in normal use before the war or which require special airborne equipment. Until an international standard is laid down not every aircraft using London's terminals will necessarily be suitably equipped. In the meantime, some all-embracing and clearly understood traffic control system should be employed.

From the manner of explanation in the statement one might imagine that the word "diversion" is, in the minds of the Ministry, equivalent to a radio aid. While diversion must be accepted as an inconvenient but necessary precaution in very extreme conditions, it must not be used as a means of dealing with a traffic situation caused solely by lack of reasonable control assistance. As things appear at present, this winter will see incoming passengers much more at the mercy of the weather than they were even in pre-war days.

Time to Ponder

THE spate of crashes from which flying has suffered lately should give us cause to ponder if we are really on the right road. There is much glib talk of flying enormous distances at speeds of 400 or even 500 m.p.h., and yet the unpleasant but inescapable fact is that we have not yet learned how to fly safely at 200 m.p.h. or so.

It is, of course, right and proper that we should strive for those higher speeds—progress demands that—but there is still far too much to be done at the other end of the speed scale. The high speeds envisaged are linked with wing loadings much higher than those in general use to-day, and yet we see accidents happening because the aircraft did not have sufficient angle of climb to clear an obstacle. It may even be necessary to review the present regulations, which already impose severe limitations on the aircraft designer and operator. The latest example, that of the Berlin-bound Skymaster which crashed into a hill near Stephenville, Newfoundland, points to insufficient climb. The weather is reported to have been clear at the time, and it is difficult to understand, on any other score, the pilot's failure to clear the hill.

From every point of view a good angle of climb is an advantage. This is not the same thing as a good rate of climb. Modern aircraft climb at high forward speed, which means that the rate of climb is fairly high, but the angle of climb may be comparatively low

Combined Operations

THE proposal to establish a Ministry of Defence is a far more logical step than many taken by the present Government. The war demonstrated to the full the vital interdependence of the Services, and if the most efficient use is to be made of the manpower and material available a unified control of all three is the obvious solution.

Much will depend upon the man put in charge, but we believe Mr. A. V. Alexander will hold the scales fairly as between the rival claims of his three Service chiefs. His close connection with the Navy may, perhaps, cause some misgivings in the other two Services, but time alone will show how far they are justified.

It is to be regretted that the reorganization of the Government should have resulted in so many changes in the various air offices, particularly in the Ministry of Civil Aviation. Lord Winster has, since he took over from Lord Swinton, managed to learn a good deal about the intricacies of international and national civil aviation problems. He is to be followed by Lord Nathan who, whatever his other qualifications may be, cannot know anything about the subject. The same may be said of Mr. G. S. Lindgren, who succeeds Mr. Ivor Thomas as Parliamentary Secretary of the Ministry of Civil Aviation. Mr. Thomas has done good work at the Ministry, and has won the respect of even those who do not share his political views. His transfer to the Colonial Office does not appear to bring him any financial promotion, whatever may be the case politically.

At the Air Ministry Mr. Noel-Baker takes over from Viscount Stansgate, who can now devote all his time to the handing-over of Egypt. The new Secretary of State for Air will be best remembered by the British aviation world for his chairmanship of the Royal Commission which, some years ago, examined the question of nationalizing the aircraft industry.

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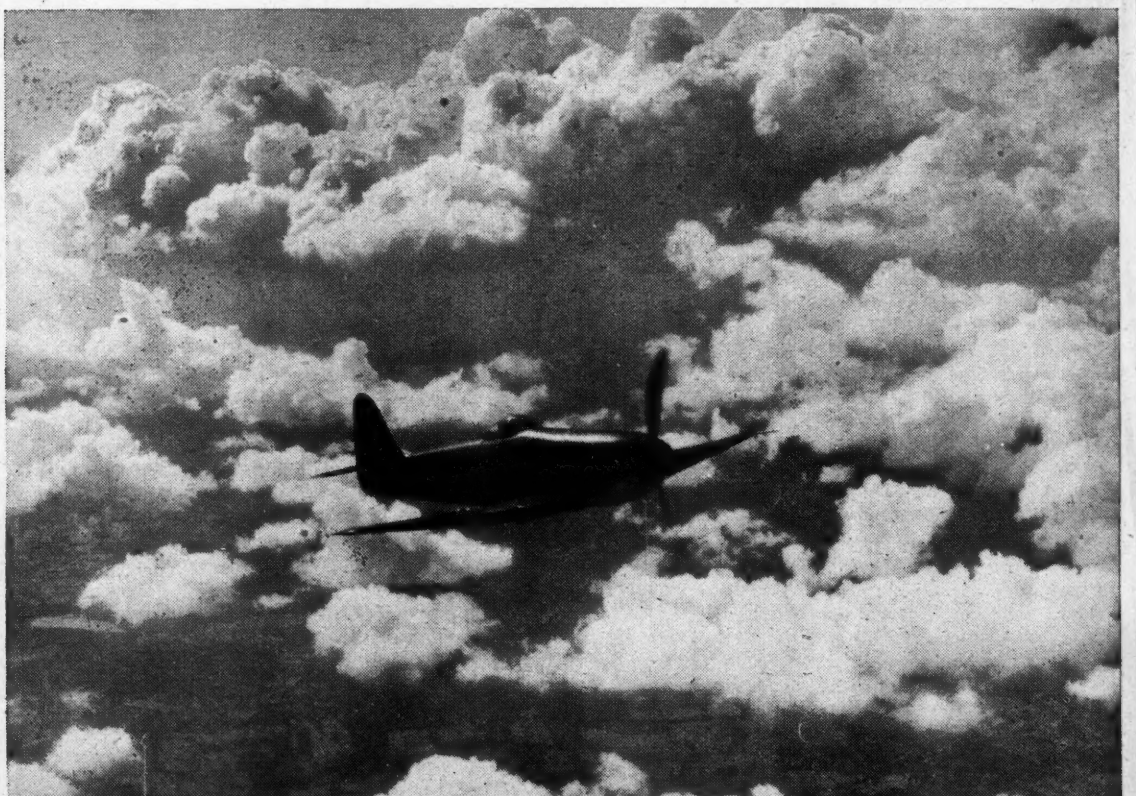
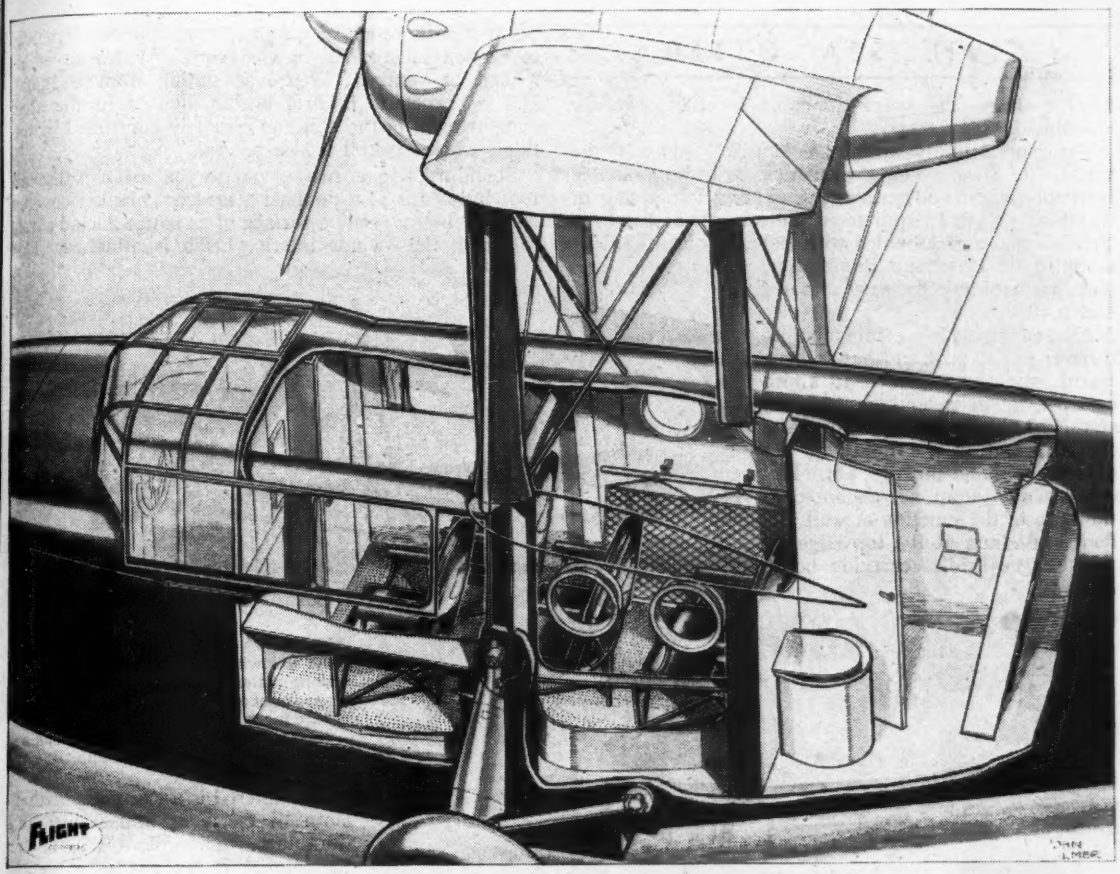
"As when that devilish iron engine, wrought
In deepest hell, and fram'd by furies' skill,
With windy nitre and quick sulphur fraught,
And ramm'd with bullet round, ordain'd to kill,
Conceiveth fire."

Spenser (1552-1559).



FURY: The spirit, if not the letter, of the quotation above seems well matched to this fine study of the Hawker Fury I powered by a Napier Sabre engine of over 3,000 h.p. and armed with four 20 mm. guns.



This special *Flight* drawing by John Palmer gives an excellent idea of the surprising roominess of the Sea Otter's cabin, as well as setting out clearly the disposition of seats and the general accommodation arrangement.

Civil Sea Otter

Neat Conversion by Vickers-Supermarine of Ex-Service Amphibian

IN these days of high-speed, jet-propelled flight and super-streamlined luxury airliners, the introduction of the Vickers-Supermarine Civil Sea Otter might at first sight strike one as being slightly belated. But against this somewhat misleading appearance must be set qualities in its operational field which make this fine little machine unrivalled. It should also be remembered that the Sea Otter was, in fact, only introduced in 1939, as a development of the very much older Walrus; and both of these aircraft have Service records which, obscured by the more spectacular exploits of first-line types, are equally glorious in their way.

The outstanding ability of these classic amphibians to do a tough job of work, to take hard treatment and yet remain seaworthy and airworthy in beastly weather, was felt to be a quality that might prove valuable in a civil market where such conditions could be expected to exist. That such a market, albeit a limited one, does exist is unquestionable, and the lack of "modern" aircraft suitable for the fulfilment of that market's demands has prompted Vickers to carry out a civilizing conversion scheme to an ex-Service Sea Otter. This particular aircraft is intended for operation in Northern Canada, and a very useful machine for the purpose it would appear to be.

As with all military-to-civil conversions, there are disadvantages inherent in the basic design owing to the incompatibility of the designed duties, but in the case of the civil Sea Otter which, it must be appreciated, is intended only for a specific field of operation, the conversion scheme is a better one than many of the more ambitious projects which have been essayed with other types.

Interior Transformation

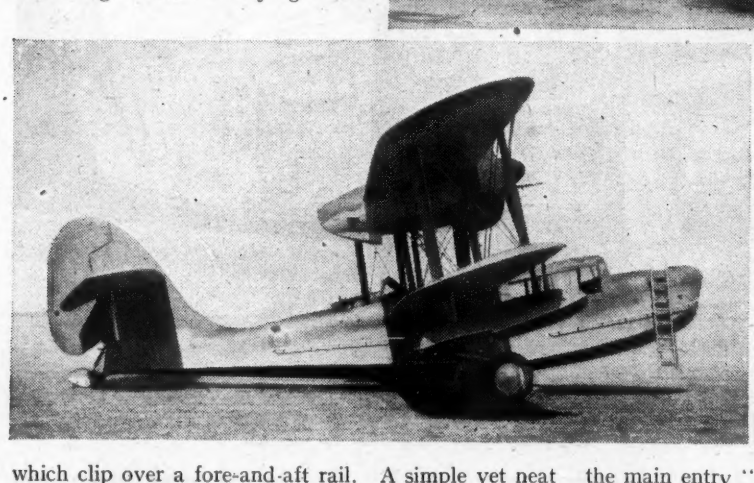
The layout of the control compartment and, in fact, the whole front-end arrangement of the boat, remains largely unchanged, but a door has been placed behind the co-pilot's folding seat to separate completely the cockpit from the main cabin. With all the Service impedimenta cleared away from the main body of the hull, a surprisingly large volume is made available for seating, although such things as control runs and the main spar frames—all of which must be boxed in—do incur unfortunate space penalties. Nevertheless, even with additional boxings in the form of ventilation and

CIVIL SEA OTTER

heating ducts, the space available is still a goodly amount.

For general utility work in a "tough" region of the world, the cabin volume must necessarily be available both for freight and passengers, either alternatively or together. For this requirement the cabin floor has been strengthened and provided with lashing points, and the modified de Havilland Rapide-type seats are arranged for easy removal and reattachment.

The seating arrangement embodies three chairs to port and one to starboard, slightly staggered to afford easy passage between them. On the starboard side of the cabin, opposite the rear seat, is a "hold-all" for passengers' hand luggage, etc. This consists of a stout net anchored at the base to the junction of wall and floor and slung at the top edge by two bungee bridles carrying hooks which clip over a fore-and-aft rail. A simple yet neat and effective device.



These two photographs, and that on the following page, are of Naval versions of the Sea Otter, but the general appearance of the civil conversion introduces little change other than deletion of martial equipment, and a brighter colour scheme.

Natural lighting is admitted to the cabin by the existing windows and ports, modification extending only to the addition of an extra port in each wall at the rear of the cabin (thus there are two per side) and to the blanking-off of part of the side windows at the front of the cabin, this latter course being rendered necessary by the deletion of the original deflector screen.

Fenestration

All windows in the cabin, including the ports, are of air-sandwich double-panel type, and the forward window on the port side is arranged as a detachable unit to serve as a 24in × 19in freight-loading hatch; the complementary starboard window is a knock-out type to act as an escape hatch. Artificial lighting is provided by four 5in diameter panels in each half of the cabin, two per side being incorporated in the ventilating ducts.

Fresh, cool air is admitted through four "mushroom" cowls in the hull deck, two per side, which feed internal ducts running along the junction of walls and roof, the air being delivered into the cabin through individual punkah louvres. Each cowl intake is arranged with a lever control so that ram intake may be shut off at the discretion of the passengers and aerodynamic extraction substituted, or vice versa. Warm air is delivered to vents at each seat station from a 15,000 B.T.U. capacity Janitrol heater, housed in the after compartment of the hull and remotely controlled by the pilot, whose cockpit it also serves.

Soundproofing is carried out to the cabin walls and roof by means of a doubled glass-wool blanket covered with an internal ceiling surface of 24 gauge Alclad sheet, to which the Vynide interior finish is attached. This latter material is a synthetic leather-cloth of excellent appearance and durability. The colour scheme for the interior is two shades of green, and light and dark fawn.

The cabin is divided from the after compartment by a half-bulkhead and door at the rear-spar station, and behind the bulkhead on the port side is an Elsan chemical closet. This rear compartment is actually the main entry "vestibule" to the cabin, since normal passenger access to and from the interior will be via the deck hatch and a companion ladder down into the hull.

The companion ladder is of wood, with wide treads, and is hooked over the hatch coaming and pegged into

CIVIL SEA OTTER.

C53 b.h.p. Bristol Mercury 30 engine driving Rotol 3-blade 11ft 3in diameter airscrew.

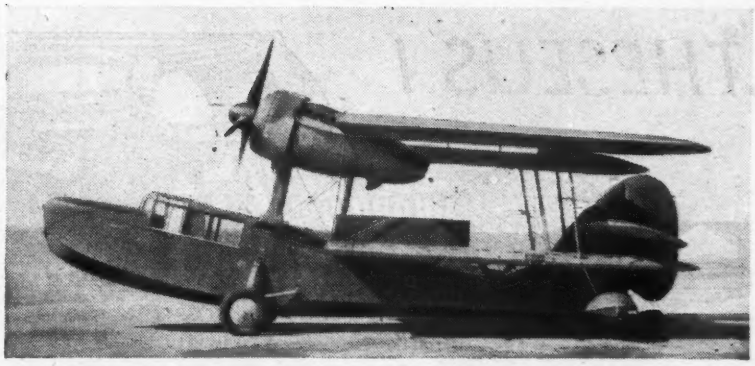
Span	46ft
Length	39ft 4½in
Height	18ft 10in
Width, wings folded	17ft 9in
Max speed—at 5,000ft	150 m.p.h.
Time to take-off, from water, still air	28.6 sec
Distance to clear 50ft, from land, still air	661 yards
Initial rate of climb	808 ft/min
Time to 5,000ft	6.7 min
Service ceiling	13,800ft
Cruising speed for max range	100 m.p.h.
Normal range	520 miles
Fuel for normal range	162 gall
Max range	700 miles
Fuel for max range	206 gall
Empty weight	6,465 lb
Fuel (162 gall)	1,166 lb
Oil	99 lb
Disposable load	2,120 lb
All up weight	9,850 lb

Note: Max range is obtained either:
(a) with disposable load of 2,120 lb, undercarriage removed, or
(b) with disposable load of 1,790 lb, undercarriage fitted.

CIVIL SEA OTTER

floor sockets. Its normal rake is 23 deg. from the vertical, but as it will be used only when the aircraft is on land or water—that is, with the tail down—the effective rake will be more like 35 deg. To climb up to the after hatch externally, a fabricated light-alloy accommodation ladder is provided, which pegs into "keyholes" in the topsides and is thus suspended against the hull.

In Service guise the after hatch was a gun emplacement, and, for this reason, its trailing edge is semi-circular in plan. The hatch cover is hinged laterally across the middle so that the rear half lifts up and folds forward over the front half, which itself is hinged on its leading edge to fold forward and so make available the full hatch aperture area. On its longitudinal axis the hatchway is 37¼in. and the internal width is 32½in. Although at first sight these dimensions would appear to be somewhat niggardly for the main access to and from the aircraft, in actual fact the area provided is more than ample.



In addition to the operational advantages of amphibians the small overall width of the Sea Otter with wings folded is of great advantage for hangarage in undeveloped regions.

The Good Ship Balaena

Off After Whales in the Antarctic : The Walrus Amphibians do Their Trials

SOME weeks ago we referred to the whaling expedition to the Antarctic which is to take with it three Vickers-Supermarine Walrus amphibian flying boats. The 15,000-ton factory ship *Balaena* ran her trials in Belfast Lough on September 28, and afterwards proceeded to sea in order to do catapult and recovery tests, first in Bangor Bay and afterwards in the open Atlantic, just south of the Hebrides.

The amphibians are launched by a catapult (cordite charge) which was previously installed in H.M.S. *Pegasus*, the Naval Air Service training ship. The *Balaena* carries all the very latest equipment for the speedy extraction and purification of whale oil, refrigerating machinery, etc. She will act as mother ship to some ten whale-catchers, in addition to the three amphibians.

Personnel for the three Walrus (*Moby Dick*, *Snark* and *Boojum*) are John Grierson, flight commodore; G. R. Collyer and N. McLean, flight captains; M. H. Routh and H. Milroy, flight navigation officers; L. Holmes and A. W. Horgen, flight radio operators. All except Grierson and Horgen are ex-Fleet Air Arm. In addition, W. C. Mitchell is catapult engineer officer (ex-Navy E.), and Leading Seaman Rogerson is crane driver. The latter has been lent by the Admiralty for the trip and is reputed to be the best crane driver in the Royal Navy. Mr. Michael Daunt, who is air adviser to United Whalers, is going with the *Balaena* as far as Southampton.

We have received from Mr. John Grierson a very cheery letter, written on board the *Balaena* on September 1, when she was off the south coast of Norway on further trials. "All our work on board," Mr. Grierson writes, "has been done under instruction from a special naval training party, commanded by Commander R. Walker, R.N., and including Warrant Officer Shepperd and Chief Petty Officer MacLean. They all served aboard H.M.S. *Pegasus* and are responsible for developing naval technique of launching and rough-sea recovery which we are employing in *Balaena*. It would be impossible to over-estimate the services which these instructors have rendered our company, as we could not have attempted this project without their assistance.

"Up to date we have made nine catapult launchings—four on Saturday, four on Sunday, and one to-day, when we sent a machine off to Tönsberg, 120 miles distant, carrying our personnel manager, Mr. N. R. Bugge.

"We have practised recovery both in Bangor Bay and from the open Atlantic, employing the three different methods of return to the ship: taxying to the hook of the crane with the ship at anchor, taxying to a towed line, and taxying on to a mat. Altogether we have practised sixteen recoveries, and thanks to our skilled naval assistance and generally favourable conditions, we have so far suffered no damage to aircraft, apart from one fire extinguisher which released itself in the engine nacelle during a rough-sea landing.

"Our naval instructors leave us in Norway, and we shall be sorry to see them go, but they have instilled in us and in the ship's company a great measure of confidence which will be an invaluable asset for the more difficult operations lying ahead. Sorry I cannot write any more, as I must rush off to the flight deck to put another machine into the air."

We wish the *Balaena* and her company success.

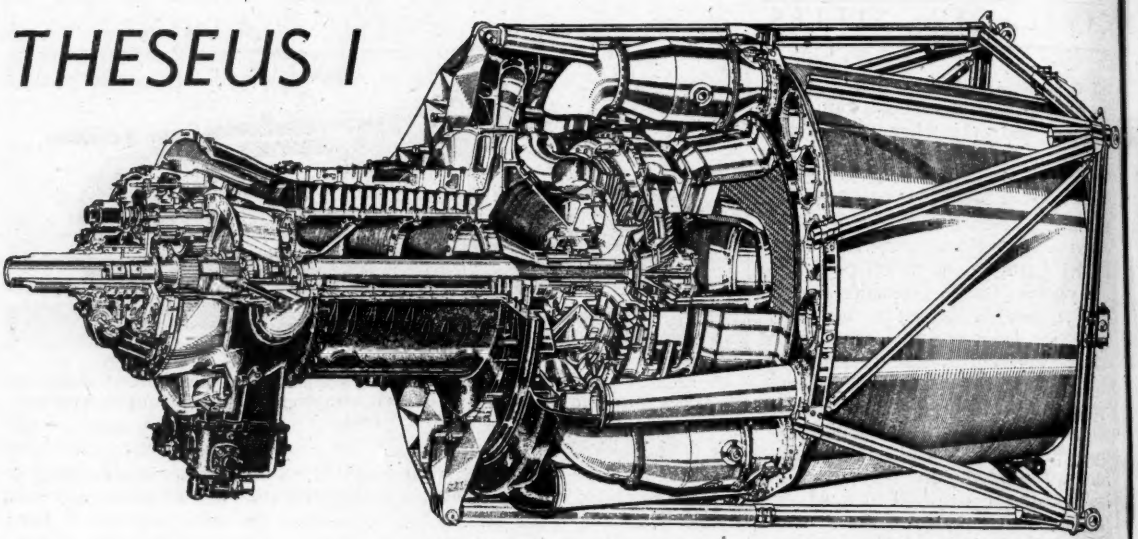
RESEARCH ON D.H.108 TO CONTINUE

SIR GEOFFREY DE HAVILLAND, on behalf of the De Havilland enterprise, announces that the De Havilland Aircraft and Engine Companies intend to continue with full effort the research work on which they were engaged with the D.H.108 at the time of the recent accident. This was primarily a study of the problems and possibilities of the swept-back wing for high-speed flight, but the attempt which it was proposed to make on the world's speed record was incidental to the experimental work.

The official investigation into the cause of the accident must take some time to complete, but it is clear from the evidence available after a complete inspection that the engine was not responsible for the accident, and reports that it blew up can therefore be denied.

Mr. John Cunningham, chief test pilot of the De Havilland Engine Co., has been appointed to succeed Mr. Geoffrey de Havilland as chief test pilot of the De Havilland Aircraft Co., Ltd.

THESEUS I



Part-section cut-away drawing illustrating the disposition of main units and affording an insight into the air and gas flow through the unique heat exchanger.

Further Details of the Bristol Turbine/Airscrew Unit

THE first announcement of the Bristol Theseus I turbine/airscrew power unit was given in the December 6th, 1945, issue of *Flight*, and since that date several references to the engine have been made.

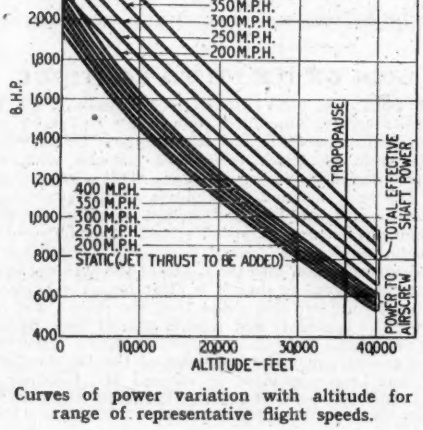
As our readers will be aware, the Theseus is a turbine/airscrew power unit employing an axial main compressor and a heat exchanger through which the jet gases are discharged. It is the only engine of its kind to employ heat energy recuperation, and reference to the cut-away drawing will clarify details of the internal design and the arrangement of main components.

Inducted air enters the compressor through an annular intake surrounding the reduction gear immediately rearward of the airscrew. The compressor itself comprises nine stages of axial blading and a final stage centrifugal impeller, giving an overall compression ratio of about 5 : 1 at 300 m.p.h. at 20,000ft. At full throttle the compressor runs at 8,200 r.p.m. and delivers 30 lb of air per sec at sea level static conditions; this is equivalent to a power input of approximately 3,500 h.p.

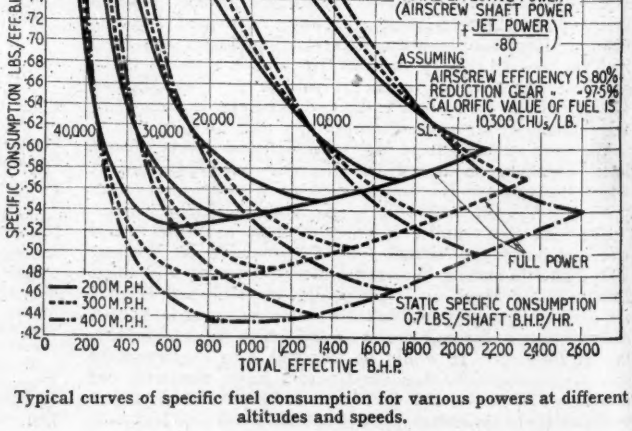
Air delivery from the compressor discharge manifold is taken by eight equi-spaced transfer ducts to the heat exchanger, a matrix type unit the tubes of which are arranged in 16 sets, 8 inlet and 8 outlet, separated by suitable headers. Air flow is radially inward, then radially outward to the headers serving the eight combustion chambers. During its passage through the heat exchanger the air abstracts heat from the hot jet gases and so is given a further measure of compression before entering the combustion chambers.

In order to mitigate differential expansion effects the heat exchanger itself is carried on the main engine mounting structure and is located at the forward end only.

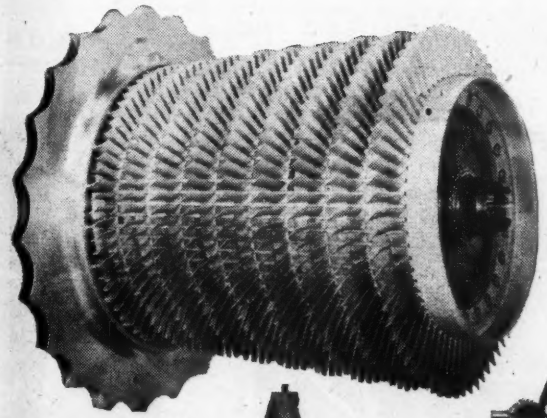
Gases from the combustion process are delivered by a tangential manifold to a ring of 48 nozzles, whence they pass through the two-stage first turbine, which powers the compressor and auxiliaries, and the single-stage second



Curves of power variation with altitude for range of representative flight speeds.

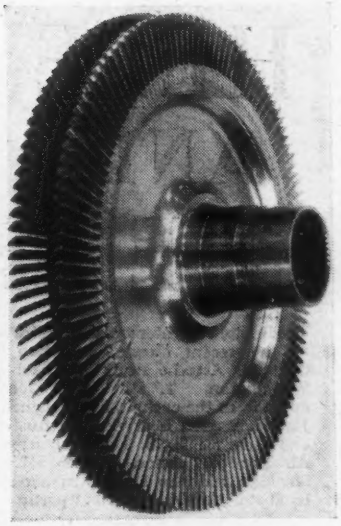


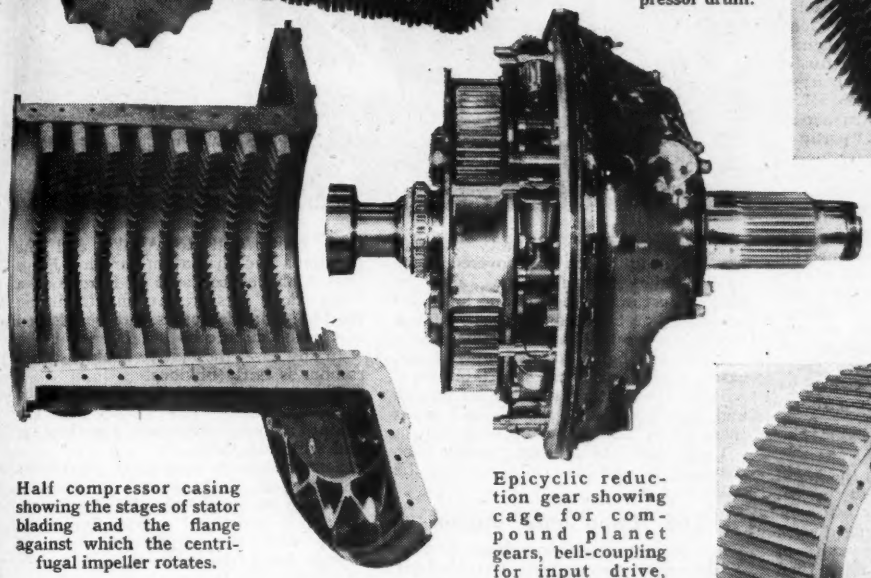
Typical curves of specific fuel consumption for various powers at different altitudes and speeds.



(Left) The nine-stage axial compressor rotor with its double-shrouded centrifugal impeller final stage.

(Right) Compressor turbine wheel showing both banks of blading for the two stages, and internally splined hub for driving compressor drum.

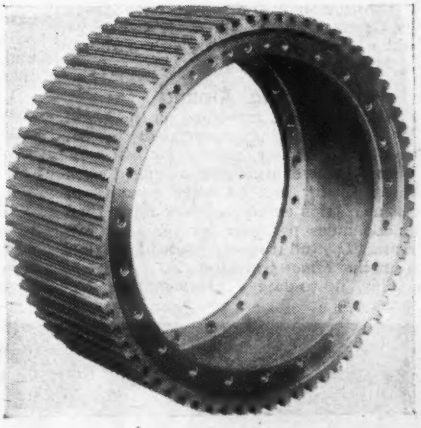




Half compressor casing showing the stages of stator blading and the flange against which the centrifugal impeller rotates.

Epicyclic reduction gear showing cage for compound planet gears, bell-coupling for input drive, and airscrew shaft.

(Below) One of the three identical sections which go to make up the compressor rotor drum. The "fir-tree" anchoring slots for the blades can clearly be seen.



turbine by which the airscrew is driven; this turbine rotates at 9,000 r.p.m. as against the compressor turbine's 8,200 r.p.m. The gases then flow through a diffuser into the heat exchanger, and are finally discharged through a variable nozzle to atmosphere.

The absence of any mechanical coupling between the compressor and airscrew turbines renders the speed control aspects of the engine performance somewhat less critical, but as the speeds of the two turbines must be kept in reasonably constant ratio to one another, an ingenious governor mechanism is incorporated whereby the airscrew blade pitch is automatically controlled to ensure the maintenance of the fixed ratio as between the two turbines.

Airscrew Gearing

The reduction gear is of epicyclic type incorporating four sets of compound planet wheels, and gives a reduction ratio of approximately 8.4: 1. Thus for the airscrew turbine speed of 9,000 r.p.m. the rotational speed of the airscrew itself is about 1,070 r.p.m.

The fixed annulus gear is mounted on torque dynamometer pistons, and this provides the additional advantage of equalising the tooth loads on all the planet wheels.

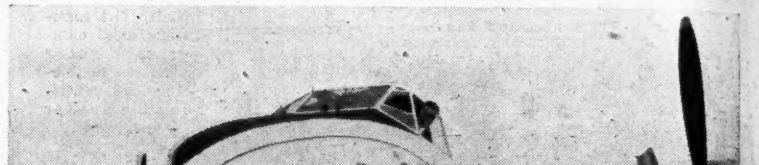
Single-lever control will be provided, and this will normally operate the fuel delivery only to obtain the appropriate airscrew speed for any given flight condition. If desired, however, this lever may also be arranged to control feathering and reversing. The airscrew shaft is a No. 5 standard and the direction of rotation left-hand tractor.

The original and main application of the Theseus is for long-range medium-speed aircraft, and Handley Page, Ltd., have announced their intention to fit these units in a prototype Hermes aircraft.

The heat exchanger, which weighs 500 lb, requires several hours' flying in order to save its own weight in fuel, and this factor makes this particular version of the Theseus essentially a long-range power unit. However, for short ranges the heat exchanger can be omitted, with the result that although fuel consumption is slightly increased, the weight is considerably reduced. It is claimed that even without heat-energy recuperation the fuel consumption is very much lower than that of contemporary jet engines and, in fact, is still of the same order as for piston engines of comparable power.

Initial flight trials will be conducted with an Avro Lincoln, the normal two outboard Merlins of which will be replaced by Theseus. It is further planned eventually to fly the aircraft with four Theseus. An extensive amount of bench testing has already been accomplished, including 100 hours' endurance at operating conditions, with satisfactory results.

HERE AND THERE



The Bristol Freighter was demonstrated at the recent farewell reception to Civil Air Attaché Peter Masefield at Washington. T. P. Wright looks down from the cockpit, flight-engineer Jim Hanington is driving the Austin, and Admiral E. S. Land (chairman Air Transport Assoc.), stands behind Mr. Masefield who lends a supporting hand to the Freighter's "portico."

Another "Aviation" Record

GOLFING enthusiasts in flying circles will congratulate Mr. H. G. Bentley, who, at the autumn meeting of the Aero Golfing Club held at the Richmond Golf Club on October 1st, not only won the Cellon Challenge Trophy, but broke the record for the course with a return of 64+2=66.

The four-ball foursomes were taken by Group Capt. P. W. S. ("George") Bulman and P. Q. Reiss with a return of two-up on bogey.

Getting Around

COMMERCIAL travelling on the grand scale is being undertaken by an ex-R.A.F. fighter pilot, Mr. R. A. Winter, whose firm have arranged with B.O.A.C. for him to make a series of business trips extending over more than 80,000 miles per year for the next five years. The full itinerary reads like a page from the *Times Gazetteer*.

This up-to-date "commercial" has just returned from his first "tour of ops" during which he covered some 17,000 miles through Africa and the Middle East in two months and four days and called on hundreds of firms. After a month's leave he'll be off again.

He travels light; just a couple of suit cases, a brief case, and a portable typewriter. He mostly writes up his reports and orders while in the air and sends them off by airmail at the next stop.

Incidentally, he is selling watches, so naturally he and his firm appreciate the value of time!

The "Lying Jade" Again

IT is no part of our duty (especially on this comparatively light-hearted page) to ascribe political motives to rumours such as the one given publicity by *The New York Times* recently when it said that Superfortresses with "atom crews" were being sent to Alaska and the Aleutians and that atom carrying B-29s were to have been sent to Europe as a "big stick" gesture last month during the U.S.-Yugoslav crisis, but were halted at the last minute by Mr. Byrnes.

In any case, the motive behind such a rumour is fairly obvious.

The plain facts, however, are that the U.S. War Dept. has stated that the Bikini bombers have returned to the U.S. and will stay there.

Some normally equipped Superforts are going to Alaska with a squadron of Mustangs for six months training in zero weather conditions, and obsolescent B-17s with the occupation force in Europe are to be replaced, as a matter of routine, by B-29s.

Restraint

REFERRING early last week to the attack on the air speed record planned for a few days later with the experimental P-84 Thunderjet, a U.S. War Department spokesman said that U.S.A.A.F. authorities had vetoed an intention to "boost the aircraft's take-off by the injection of a mixture of water and alcohol."

Whether this was to be applied to the engine or the pilot was not stated.

The Proper Channels

THE silly business of the damaged Firefly on a trailer which was left to the mercy of souvenir-hunting small boys on Wimbledon Common from Monday until Wednesday night of last week while the head ranger of the common and later the police tried to persuade the Air Ministry or the Admiralty to rescue it, provided a brilliant example of how the Service mind clings resolutely to strict formality.

The Air Ministry was first approached and refused to do anything "until after enquiries" although it might have been an R.A.F. machine for all they knew at the time; the Admiralty at first denied it was theirs although told by the police it was a Naval aircraft, and when tackled again as late as the Wednesday afternoon admitted they had not been to look at it and added that they did not know

FLYING POST OFFICE: Mail being sorted during flight in the specially-equipped cabin of a Trans-World Airline Skymaster, claimed to be the world's first aerial post office. Note that the armed clerks are apparently all left-handed gunmen!

HERE AND THERE

from where it had come. Later that evening, however, they sent a lorry to tow it in.

*

The ordinary, commonsense idea of *doing something about it* first, and asking all the regulation questions afterwards, could not, of course, be countenanced by any Service department.

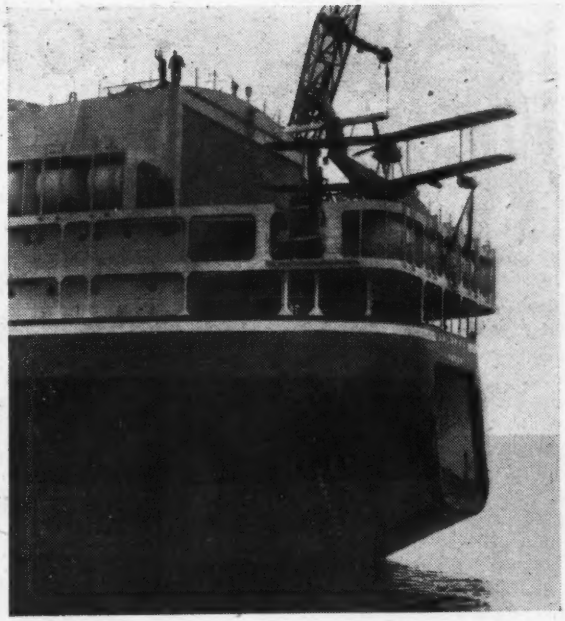
As Lord Otterstream is said to have observed to his editor, "It would be an even better story if only we could find some way to blame it on the Government!"

Glamour Girls Barred

HUNDREDS of applications are being received every week by British European Airways from girls in every walk of life who want to be stewardesses on the Continental air routes, and many of them are seeking the job because they want to travel, or to meet famous people, or just because the job is "different."

But B.E.A. has made it clear that such jobs are for serious-minded working girls; glamour girls need not apply.

Applicants must have intelligence, courtesy, and know at least one foreign language besides being of good appearance. Most of all, they must have "the right attitude of mind" towards the job; they must regard themselves as "true servants of the public" and be prepared to wear the airline's uniform, salute senior officers—and forgo nail-varnish!



WORKS ENTRANCE: The stern of the whaling factory, *Balaena*, has a large aperture through which the "raw material" is hauled aboard. Catapulted Walrus do the whale-spotting.

News in Brief

ON his appointment to the board of Associated Electrical Industries Finance Co., Ltd., Mr. E. S. Little has retired from the B.T.-H. board, but continues to be controller and secretary.

* * *

Mileage flown on the daily K.L.M. service between Miami and Curacao totalled 1,108,120 miles for the first six months of this year, an increase of 50 per cent over the whole of 1945. Passengers carried numbered 25,751.

* * *

The activities of Airtraining (Fair Oaks), Ltd., and Airtraining (Oxford), Ltd., have been combined under the name of Universal Flying Services, Ltd., with Mr. G. Goodhew as managing director. The companies are subsidiaries of General Aircraft, Ltd.

* * *

Mr. C. F. Russell, general manager of Specialloid, Ltd., has gone to Montreal to complete the organization of the firm's recently established factory there. While abroad he may also visit the company's Buenos Aires branch and some of its South American customers.

* * *

As its share of money raised by the sale of cigarettes and tobacco parcels which failed to reach prisoners-of-war, the R.A.F. Benevolent Fund has received £44,000. R.N. and Army charities receive equal amounts. The parcels were sold overseas after Press announcements that the proceeds would be divided between the Services.

* * *

The Graviner Manufacturing Co., Ltd., announce that their catalogue of airborne fire-fighting equipment is now available to the aircraft industry. It contains a considerable amount of information—data, installation diagrams, etc.—for aircraft constructors, chief designers and engine manufacturers.

* * *

Vice-Admiral Marc A. Mitscher, U.S. Deputy Chief of Naval Operations for Air, has been appointed Commander of the U.S. Eighth Fleet in the North Atlantic. He commanded the carrier *Hornet* from which Maj. Gen. Doolittle made his famous Mitchell raid on Tokyo, and later commanded carrier task forces in the Pacific.

* * *

Mr. C. J. Knight, who has been with the Hoyt Metal Co. (Great Britain), Ltd., for 34 years, has just retired from the position of managing director but remains on the board as consultant. Mr. J. Campbell Hart has joined the company as managing director, and Mr. Charles F. Bone, secretary for ten years, has been appointed to the board.

* * *

Recent changes in the executive personnel of the Northern Aluminium Company include the appointment of Mr. E. V. Hill as general sales manager, Mr. T. E. Nixon as manager of the firm's London office, and Mr. J. H. Mayes as manager of their technical development department.

* * *

Lt. (A.) A. E. Bristow, R.N.V.R., has relinquished command of a R.N. Helicopter Unit to take up the post of assistant manager of the aviation division of R. K. Dundas, Ltd., at the London offices, Flt. Lt. T. A. Sadler having left to take up a post in India.

* * *

The Royal Aircraft Establishment Scholarship for apprentices, tenable for a two years' course at the College of Aeronautics, has been awarded this year to Mr. R. J. Ross, who also won the R.A.E. diploma in engineering. The scholarship not only covers tuition and maintenance, but provides a spending allowance.

* * *

Mr. G. E. Beharrell, Dunlop's managing director, has flown to America by American Overseas Airways to visit the company's factories in Buffalo and Toronto. He is to return on the *Queen Elizabeth* on her first peacetime voyage from New York about the end of the present month.

* * *

Mr. F. C. Lynam and Mr. E. C. F. Pash, technical and sales managers respectively of The Airscrew Co., Ltd., have been appointed to the firm's board of directors.

AIRSTRIP . . . . No. 34

FOR HIGH-SPEED RESEARCH

The New N.A.C.A. Low-turbulence Pressure Wind Tunnel

Part-sectioned view of the 12ft tunnel. The balances are in a pressurized cylinder which surrounds the test section. The control room is next to the cylinder.

IN view of the announcement made recently by Sir Ben Lockspeiser, Director of Scientific Air Research, that high-speed wind tunnels will figure prominently in the equipment of the new National Research Establishment at Thurleigh, Bedfordshire, a few particulars of the new high-speed wind tunnel erected at the Ames Aeronautical Laboratory of the American National Advisory Committee for Aeronautics at Moffett Field, California may be of interest in showing what has already been done in this direction.

Outstanding features of the new tunnel are a high maximum tunnel speed (up to 750 m.p.h.) combined with an almost total absence of tunnel turbulence. The importance of this latter lies, of course, in the fact that not only is time saved by the absence of need for turbulence corrections, but that there is no reliable method of completely correcting for tunnel turbulence in applying results to full-scale, free-flight conditions.

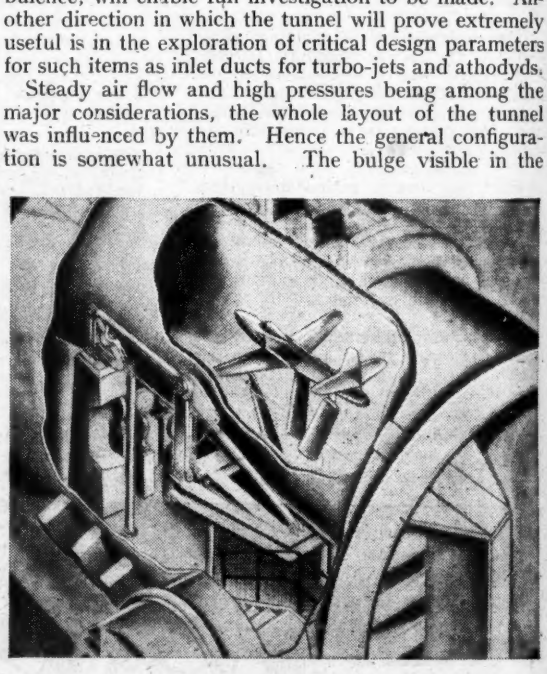
Versatility

In addition to these features, the new N.A.C.A. tunnel has the advantage that pressure in it can be varied from one-sixth atmosphere to six atmospheres. This enables the Reynolds Number to be varied without changing the size of the model or the tunnel air velocity. For example, when the air in the tunnel is compressed to six atmospheres, a model having a 10ft span will give data which are directly applicable to a full-size aircraft of 60ft span.

Versatility in the working of the tunnel is afforded by the variation of density. For a given power input, the change of density permits a wide range of tunnel air velocities. Thus at pressures below one-third atmosphere an air speed of 750 m.p.h. is attainable.

The working section has a diameter of 12ft, which enables complete detailed models to be tested. Conversely, the tunnel can be used for two-dimensional investigations of aerofoils, or for testing semi-span wing and tail models. Although the N.A.C.A. developed very successfully in the older tunnels, the so-called laminar-flow aerofoils for high-speed performance, the limited research facilities then available did not permit full exploitation of laminar-flow principles, and the new 12ft tunnel, with its large working section and low turbulence, will enable full investigation to be made. Another direction in which the tunnel will prove extremely useful is in the exploration of critical design parameters for such items as inlet ducts for turbo-jets and athodyds.

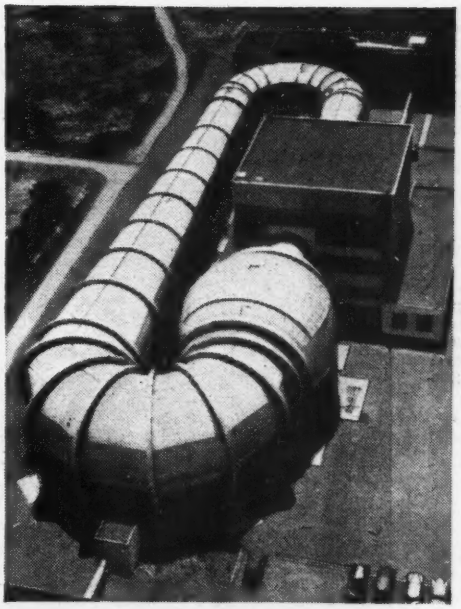
Steady air flow and high pressures being among the major considerations, the whole layout of the tunnel was influenced by them. Hence the general configuration is somewhat unusual. The bulge visible in the



A model on its three-point support. For high-speed tests the model is mounted on a sting by the tail, and forces measured by strain gauges in the model.

pictures is the spherical air-straightening chamber, and the U-shaped ends, which contrast with the more usual four right-angle turns at the ends of a wind tunnel, were adopted in order to give greater structural strength to resist the stresses set up by the high pressures. The spherical anti-turbulence sphere is placed up-wind of the working section and houses the straightening vanes.

At the downstream end of the tunnel is installed the power equipment, etc. The two fans, of 22ft 8in diameter, have aluminium blades, the front fan having 12 and the rear fan 20. Blade pitch is adjustable from the master control panel. The fans are driven by two electric motors, an a.c. and a d.c. The driving shaft to the fans is a steel tube of 30in outside diameter. Coarse speed control is obtained by a liquid rheostat operating with the 9,500 h.p. a.c. motor, and fine speed control through operation of the d.c. motor.



An air view of the 12ft high-speed pressure tunnel. The bulge is the spherical anti-turbulence chamber.

In addition to the fan-driving motors, there are motors of 4,500 h.p. total driving the air compressors, and a motor of 200 h.p. driving the coolant compressor. The fan-driving motors could not be located inside the tunnel because of the pressure, and are situated outside, where they drive the fans through the shaft and flexible coupling, the shaft passing through a pressure seal. Three multi-stage compressors, capable of handling a total of 25,000 cu ft of air per minute, are employed to compress and evacuate the air. Less than two hours are required to raise the air density to six atmospheres.

Normal mounting of models to be tested in the tunnel is the conventional three-point streamlined strut support for three-dimensional investigations. For high-speed investigation, the model is mounted by its tail on a sting support downwind of the model. At critical speeds all interference and shock waves occur well behind the model, so that the accuracy of the measurements is not upset. Forces acting on the models are measured by strain gauges located within the model itself.

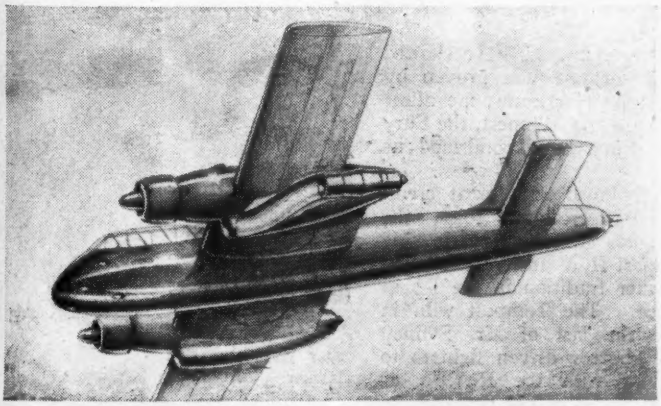
Balances, turntables, etc., are, of course, located outside the tunnel, in a pressurized cylinder which surrounds the test section, and changes in angle of yaw and angle of the incidence of the models are remotely controlled from the single control station, located next to the pressurized test chamber. From the control station, master controls regulate air density and air velocity. Tunnel pressure reduction is accomplished from the panel by control of a motor-operated blow-off valve. Flow of the cooling water over the tunnel shell is also regulated from the control station.

The tunnel itself is a steel shell, the plating of which varies in thickness from ⅜in downstream of the test section to 2¼in in the large section just upstream of the anti-turbulence sphere. The shell plates are joined by arc welding. Because of the unusual problems of movement under changes of temperature and pressure, the entire tunnel shell is permitted to float freely on 52 pin-ended column supports. There is only one rigid point of support. That is where the tunnel shell is fixed to the forward end of the pressurized cylinder which surrounds the test section. The cylinder itself is securely anchored in a block of concrete. At the downstream end of the pressurized cylinder, the tunnel shell is contained in a flexible steel pressure seal.

MIXED POWER PLANTS

THE discussion of the Nene-Lancastrian in the September 26th issue of *Flight* lends interest to German intentions which never reached fruition.

Blohm and Voss proposed a general-purpose aircraft (Project 203) with two BMW 801 piston engines and a pair of Heinkel-Hirth 011 jets. Estimated performance was 415 m.p.h. at sea-level and 570 m.p.h. at 39,000ft.



An impression of the Blohm and Voss P.203 with two BMW 801 and two He S011 jets. The installation of one jet unit is shown cut away.

The Focke-Wulf concern suggested a Ta 400 bomber (six BMW 801) with two auxiliary Jumo 004 turbine jets, and there was a scheme for supplementing the four BMW 801 engines of the Me.264 with two 018 jet units, each of 7,500 lb thrust. Some indication of expected performance is provided by the following figures: top speed with piston engines only, 355 m.p.h. at 20,000ft; top speed with jets only, 442 m.p.h. at 24,500ft; top speed with all four units, 490 m.p.h. at 24,000ft.

The Me.264, incidentally, was a promising type and was initially designed for propaganda flights to the U.S.A. Two prototypes were built, but neither of these had supplementary jet propulsion.

Like ourselves, the Germans employed piston-engined aircraft as flying test-beds for their new jet units. A Ju 88, for example, was fitted with an underslung Jumo 004 axial-flow unit.

Curiously enough, the Me 262, used by the *Luftwaffe* with twin Jumo 004 jets, was originally flown with a single Jumo 211 piston engine of the type used in the Ju 88.

Finally it is of interest to record that the Argus tube or impulse duct unit (As 014, or Argus Röhr) as used on the "V-1" flying bomb, was initially installed on a Heinkel Kadett trainer. It was slung beneath the fuselage.

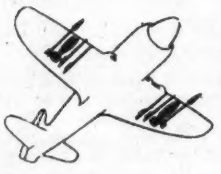
Alternative Equipment & All-up Weight

Four 20 mm guns, 580 rds. ammn., 12,025lb (5455 kg)

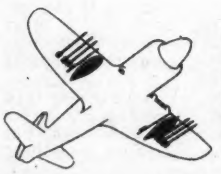
Four 20 mm guns, 580 rds. ammn., two F/24 cameras, two 90-gallon (409-litre) tanks, 13,615 lb (6,175 kg)

Four 20 mm. guns, 580 rds. ammn., two 1,000lb. (454 kg) bombs, 14,250 lb (6,465 kg)

Four 20 mm. guns, 580 rds. ammn., four triplex R.P., 180 lb (82 kg) heads, 13,280 lb (6,025 kg)



Four 20 mm. guns, 580 rds. ammn., two 500 lb (227 kg) bombs, two triplex R.P., 180 lb (82 kg) heads, 13,745 lb (6,235 kg)



Four 20 mm. guns, 580 rds. ammn., two 45-gallon (204-litre) tanks, six 5in R.P., 60 lb (27 kg) heads, 13,665 lb (6,200 kg)

Four 20 mm. guns, 580 rds. ammn., two 45-gallon (204-litre) tanks, two smoke curtain installations, 14,010 lb (6,355 kg)

Mr. "Bill" Humble taxies out a Hawker Sea Fury X (Rolls-Royce Centaurus XVIII engine) for the start of his unsurpassed demonstration

GOODLY HERITAGE

The Hawker Fury and Sea Fury : Last of a Great Line of Airscrew-driven Fighters

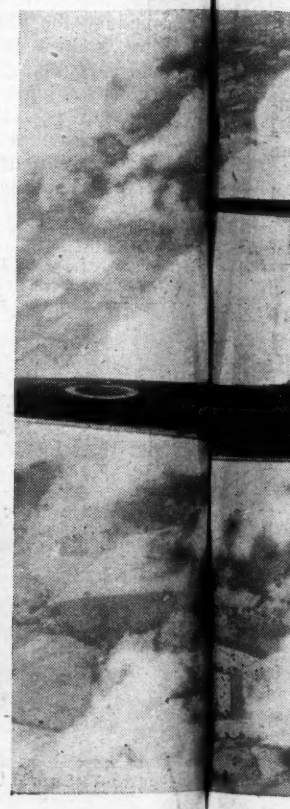
WHEN "Indicator" recently recalled his impressions of the Hurricane, he described it as the first of the "modern" fighters. By implication he justly gave the Hurricane credit for having introduced a classic formula which can be written as:—

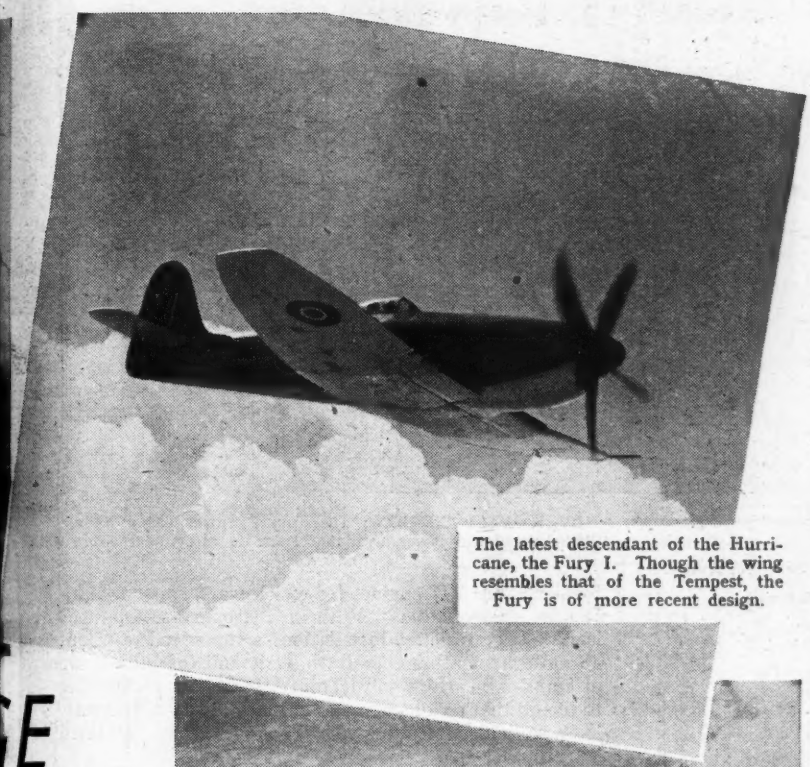
Low-wing cantilever monoplane of moderate loading + retractable undercarriage + flaps + enclosed cockpit + outboard multi-gun armament = Optimum efficiency in a single-seat fighter with airscrews propulsion.

Nearly eleven years have elapsed since this formula was proven by the prototype Hurricane; meantime the Typhoon and Tempest, the Fury and Sea Fury have confirmed its validity.

Having played with great credit its varied operational rôles, the Typhoon has gone its way, leaving the Tempest II, V and VI to sustain the Hawker tradition in the Royal Air Force. The Tempest will, in fact, be the last of Mr. Sydney Camm's airscrew-driven fighters to see service with the R.A.F., as current policy does not demand the quantity production of the Fury I. Naval requirements, however, are

Mr. Sydney Camm, O.B.E., F.R.Ae.S., Chief Designer to Hawker Aircraft Ltd. Assistant Chief Designer is Mr. R. H. Chaplin, B.Sc., F.R.Ae.S



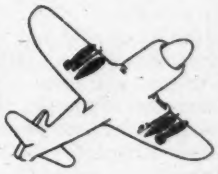


The latest descendant of the Hurricane, the Fury I. Though the wing resembles that of the Tempest, the Fury is of more recent design.

It would be difficult to select a viewpoint which would show to better advantage than the above, the power plant installation on the Fury I.

Alternative Equipment & All-up Weight

Four 20 mm. guns, 580 rds. ammn., two 45-gallon (204-litre) tanks, four triplex R.P., 180 lb (82 kg) heads, 14,075 lb (6,385 kg.)

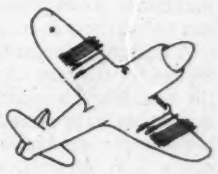


Four 20 mm. guns, 580 rds. ammn., two 45-gallon (204-litre) tanks, two 500 lb (227 kg) bombs, 13,915 lb (6,310 kg)

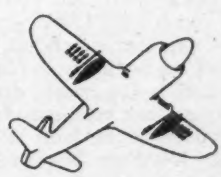
Four 20 mm. guns, 580 rds. ammn., two 45-gallon (204-litre) tanks, two clusters, 13,795 lb (6,255 kg)

Four 20 mm. guns, 580 rds. ammn., two 90-gallon (409-litre) tanks, 13,535 lb (6,140 kg)

Four 20 mm. guns, 580 rds., ammn., twelve 3in R.P., 60 lb (27 kg) heads, 13,240 lb (6,005 kg)



Four 20 mm. guns, 580 rds. ammn., twelve 5 in R.P., 60 lb (27 kg), heads, 13,680 lb (6,205 kg)



Four 20 mm. guns, 580 rds. ammn., two 45-gallon (204-litre) tanks, two L.S. carriers, with 8 practice bombs, 12,945 lb (5,870 kg)

GOODLY HERITAGE

amply met by the Sea Fury X, a deck-landing fighter-bomber, the latest performance figures for which are set out below.

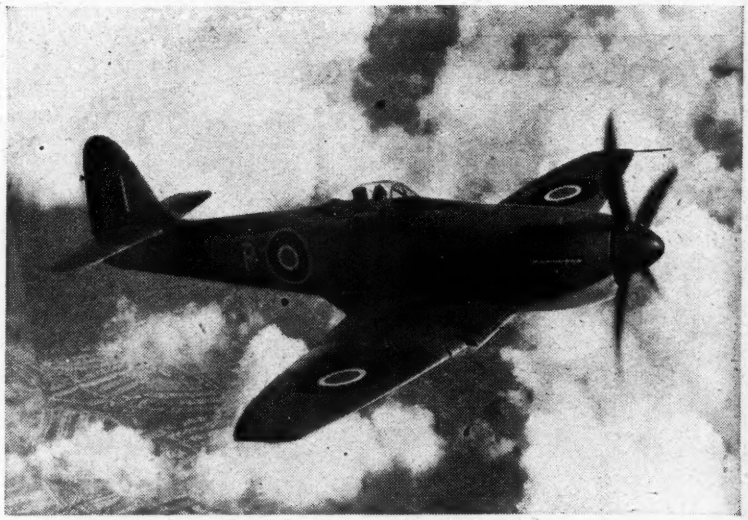
Air Marshal Sir Alec Coryton has declared that future fighters for the R.A.F. will be jet-propelled. It is unthinkable that the name of Hawker should not continue to be linked with high-performance fighters, and there is every justification for supposing that some outstanding jet machines will emanate from Kingston. Until a new prototype is announced, the Fury and Sea Fury will keep the firm's name prominent in Service aircraft design.

The performance table of the Sea Fury X shows that, with the Centaurus engine operating at 14 lb boost pressure, this type attains 460 m.p.h. at maximum-power altitude, and that a height of 20,000ft can be reached in considerably less than five minutes.

A striking comparison is afforded with corresponding figures for the famous Fury biplane of fifteen years ago: the Sea Fury is almost exactly twice as fast and has double the rate of climb. This is the more remarkable because the old biplane, which set the pace in its day, was a light intercepter, unhampered by Naval gear and carrying a very light military load, including only two machine guns—and these of rifle calibre! Its Naval counterpart and contemporary—the Nimrod—had an appreciably lower performance.

Another significant fact is that the high performance of the Sea Fury has been reconciled to range, and reference to the loading diagrams will show that range, in its turn, has not been unduly penalized by Naval requirements in the form of external loads.

The Fury I is an R.A.F. prototype, powered by a Napier Sabre VII engine, for which water/methanol injection is available. With a "tropical-suitability" leading-edge radiator installation, a top speed of about 485 m.p.h. is attainable at 16,000ft and the initial rate of climb is nearly 5,500 ft/min. It is now permissible to record that as long ago as February, 1943, a Tempest, likewise with a leading-edge cooling system, attained 470 m.p.h.



OVER WEST LONDON: The Fury I cruises easily on a fraction of the power available from its 24-cylinder Sabre engine.

SEA FURY X

Deck-Landing Naval Fighter with Bristol Centaurus XVIII Engine

Performance at 2,700 r.p.m. (+ 14 lb Boost)

Standard Altitude (ft)	True Air Speed (m.p.h.)	Rate of Climb (ft/min)	Time to Height (min.)
—	402	5,050	—
3,000	421	4,650	0.60
12,000	433	4,440	2.67
16,000	460	3,900	3.75
20,000	454	3,400	4.72
30,000	432	2,150	8.34

Take-off

Deck take-off distance in 27-knot wind with flaps set at 20 deg.

Take-off Weight (lb)	Take-off Deck run (ft)
12,000	358
14,000	505

Still air take-off with flaps at 20 deg.

Weight (lb)	Ground run (ft)
12,000	730
14,000	1,030

Range

Max. still-air range with two 90-gallon drop-tanks, 2,080 miles at 320 m.p.h at 30,000ft. Radius of action, 820 miles at 10,000ft. Fuel expended as follows:

Run up	22 galls.
Climb to 10,000ft	10 "
Cruise at most economical speed	136 "
Combat for 15 mins.	66 "
Cruise return	128 "
Reserve	18 "
Total capacity	380 "

Rapid Roll

One of the most striking characteristics of the Fury and Sea Fury, demonstrated at frequent displays throughout the year, is their extraordinarily rapid rate of roll. Of the order of 100 deg a second, this is achieved by the use of spring servo-tabs on the ailerons. A contributory factor is the short span—38ft 5in, compared with the 41ft of the Tempest. The spring tab feature is also incorporated in the rudder.

Structurally the Fury and Sea Fury differ from all previous Hawker fighters in having a completely monocoque fuselage; the familiar braced structure has gone for ever.

Visitors to the S.B.A.C. Display at Radlett remarked on the exceptional quality of the skinning and observed that, despite refinement of aerodynamic design, the whole airframe suggested stiffness and strength in exceptional measure.

DREAMBOAT TO CAIRO

IN recording, on pages 398-9, the great flight of the *Truculent Turtle*, we looked forward to comparing this achievement with that of the Boeing B-29 Superfortress *Pacusan Dreamboat*. The *Dreamboat's* flight, from Honolulu, *via* the North Pole, to Cairo, totalled about 9,500 miles, and was completed on Sunday, October 6th, in 39 hours 36 minutes.

As we go to press there is some uneasiness because *Dreamboat* was not intercepted over England and escorted by Fighter Command, as intended. It is claimed, by way of explanation, that a three hours' warning, requested by Fighter Command from the American authorities, was not given, and that it was not until an R.A.F. radio station near London picked up the Superfort that the Command was aware of her presence. Amateur operators claim to have detected the *Dreamboat* nearly an hour before.

Repair of Stressed-Skin Airframes

The Importance of Stress Transfer : Danger of Potential Differences with Dissimilar Metals

By JOHN T. HENSHAW, A.F.R.Ae.S.

IT is probably true to say that efficient repair of aircraft is as difficult as efficient design. Both are highly skilled operations requiring considerable knowledge and experience if the many problems which arise are to be overcome. The engineer in charge of repairs must have as sound a knowledge of the principles of design and construction as the designer has if he is to be really efficient. If he has not, his repairs may not be strong enough and will probably be heavier and more involved than necessary.

The simplicity or difficulty of a particular repair depends more upon the position of the damage than upon the extent. For example, a small crack in a main plane spar boom close to the root joint may be much more troublesome than, say, an extensively damaged skin panel in the rear fuselage. Hence, slight damage in a highly stressed region may call for a major repair.

Regions of high stress cannot be defined in detail to cover all aircraft, since, obviously, the individual design governs the stresses present in any one component. It is possible, however, to name those components of the airframe which are heavily loaded under various conditions, and it is also possible to indicate certain features of design which cause high stresses to develop and which must, therefore, be regarded as danger points when assessing damage. These points are shown in Fig. 1.

Chief of the vital components on most aircraft are the spars, particularly the booms. Repairs here may be critical. The loading on the spars increases as the wing root is approached, and generally the stresses increase also, reaching a maximum at the wing root.

The centre section, embracing both main planes and fuselage, is often regarded as the foundation of the airframe and, because it is required to transmit the flight loads from the fuselage to the wings, it is, in all cases, heavily loaded. It is interesting to note that the centre section acts as the root of four cantilever beams, namely, the front and rear fuselage sections and the port and starboard main planes, with the result that the centre section is heavily loaded on all sides.

The principle of stressed-skin design requires continuity of the stringers and skin if the strength is to be satisfactory. When holes are cut in the skin, this continuity is destroyed and difficulties arise. Unfortunately, cut-outs for hatches, doorways, access holes, etc., are essential, but the designer overcomes any weakness by fitting stiffening frames around the openings. The purpose of these frames is to divert the load in the skin and stringers and carry it round the opening, thus avoiding any appreciable loss in strength. It will be apparent that the frames carrying these diverted loads are likely to be heavily loaded and, for this reason, damaged framings should be treated carefully.

Damaged longerons also require careful treatment, especially when affected in the region of the centre section, and no risks should be taken with doubtful repairs. Stringers, too, in spite of their comparatively small size, are vitally important members. In repair the original continuity must be retained and the stringer securely riveted to the skin. Otherwise the value of the combination of skin and stringer working together as a single unit is lost.

Heavily loaded wing ribs or fuselage formers which have special duties are also likely to be highly stressed. In this class we can include ribs supporting fuel tanks, undercarriages and engine mountings; fuselage formers supporting main plane or tailplane spars or tailwheel beams; or any formers or ribs carrying similar heavy, concentrated loads. Other formers and ribs are usually only lightly loaded.

The undercarriage and engine mountings are, of course, very heavily loaded, and it is common practice to forbid any structural repairs to either of these components. Concession may, however, be granted to repair certain of the less critical members, which the designers are prepared to accept with a slightly lower strength, but, in the absence of official instructions, repairs to these components should not be attempted.

Other components to which repairs are often forbidden are the control surface spars. As a precaution against flutter, the ailerons, elevators and rudders must be torsionally stiff. This requirement is always fulfilled in the original design, but, owing to the difficulty of making repairs as stiff as the original spar, repairs to these parts are often forbidden. If, therefore, such repairs are permitted, particular attention should be paid to torsional stiffness.

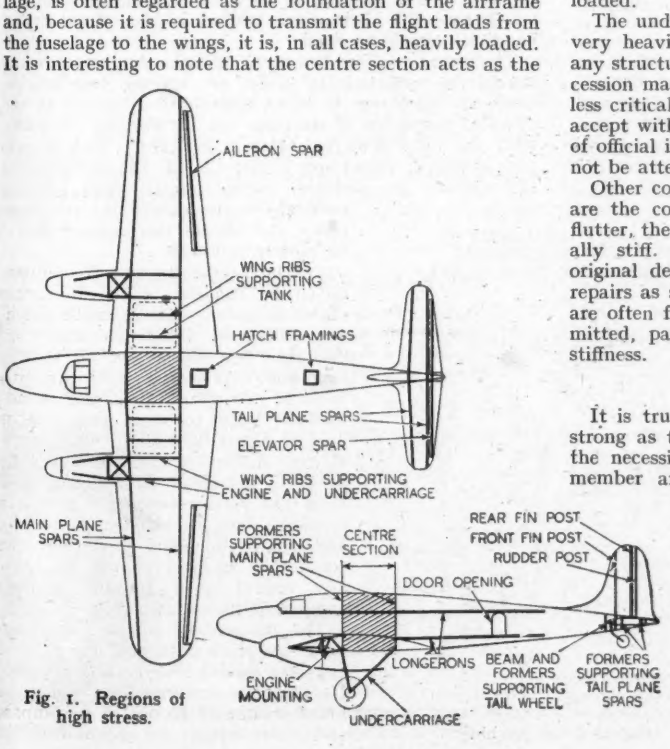


Fig. 1. Regions of high stress.

Strength of Repair

It is true that in many cases a repair 100 per cent as strong as the original member is not possible, owing to the necessity of drilling rivet or bolt holes in both the member and the patch plates, but maximum strength should always be aimed at.

With this end in view the proposed repair should be considered with three points in mind:—

(1) Has the patch plate or insertion piece been allowed sufficient overlap to form an efficient attachment? Length of attachment is very desirable, as it enables the load to spread gradually into the sound structure.

(2) Does the repair enable the load to pass directly from one side of the joint to the other? In a built-up member all the parts

REPAIR OF STRESSED-SKIN AIRFRAMES

must share the load and, if one of them is cut, the load it carries must find another path. In so doing it may overload an adjacent member. Discontinuity of repair members within the length of the repair should, therefore, be avoided.

(3) Considering any cross-section through the repair, is the strength at that section as nearly as possible that of the original member? Where the same or equivalent material is used, the cross-sectional area at all points in the repair should be at least equal to that of the sound member.

If these three requirements are fulfilled, and if the patch plate or insertion piece is similar in design to the member which it repairs, the structural arrangement should be satisfactory.

Reinforcing plates and insertion pieces should have embodied in them any method of stiffening which is present in the sound member. For example, a member shaped as that in Fig. 2A, if repaired with a patch or sleeve shaped as shown in Fig. 2B, would not be as strong as the original member. If the patch is to be as stiff as the sound member it must be shaped to fit as shown in Fig. 2C.

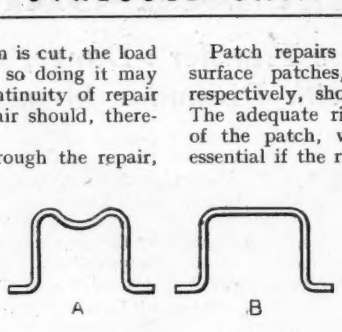


Fig. 2. Sleeve shaping.

When a former is buckled it may be permissible to dress it back to shape and, if no cracks are then present, to accept it as repaired without reinforcement. This practice is not without its dangers, however. Duralumin, in its hardened state, does not react kindly to working without heat treatment, and it is likely that the beating of a buckled former will damage the already strained crystalline structure of the metal and destroy or further impair its properties. For this reason any heavily-loaded member which may be damaged should have reinforcing plates fitted after being dressed back to shape.

Skin Plating Repairs

The skin plating on a stressed-skin airframe is, of course, a vital member. On its strength, and the efficiency of its combination with the stringers, the strength of the airframe mainly depends. Skin plating repairs are, therefore, very important and, even though they are not usually as involved as repairs to the internal structure, their planning requires care.

Patch repairs to the skin fall into two main classes: surface patches, and flush patches. Figs. 3 and 4, respectively, show the essentials of each class of repair. The adequate riveting, made possible by ample overlap of the patch, will be noticed in each case. This is essential if the repair is to be efficient, as the load in the skin must travel across the patch plate and can do so only if the attachment is strong enough to pass the load from the sound skin into the repair plate.

If the damage is adjacent to formers or stringers, it is advisable to make the patch large enough to pick up the adjacent members. This ensures a more rigid attachment and makes a stronger repair.

It will be noticed from an inspection of the skin laps of any stressed-skin airframe that additional rivets are always fitted along the joints. Close-pitched or double-row riveting is found at the joints, while the remaining rivets in the panel are more widely spaced. These extra rivets are fitted at the joints between the panels to enable the load in the skin to pass from one panel to the next, and they are the only means by which this transference can take place. Riveting at lap joints must, therefore, always be adequate.

Practical Considerations

In the actual repair there are several features which, although well known, are important enough to call for more than a passing reference.

First, there is the question of material. Where possible, repair parts should be made from material of the same specification as that of the components being repaired. If this material is not available, it may be permissible to use material to an equivalent specification, in which case the alternatives quoted in the official repair handbook should be used.

The use of steel for the repair of light-alloy components should be resorted to only on special instructions. Generally speaking, it is an undesirable practice as the physical properties of steel prevent its working efficiently with the light alloy to which it is fixed. Such repairs are, however, sometimes called for by the designers of the aircraft in positions which render more efficient methods impossible and, in these cases, the official instructions should be closely followed.

Another difficulty is often introduced by the use of an alternative material, namely an excessive potential difference, which increases considerably the danger of electrolytic corrosion. As will be seen from the table of potential values, this is particularly liable to occur when steel is used to repair light-alloy components. Where dissimilar metals must be used, a potential difference greater than 0.25 volts between the metals in contact should be avoided if possible, and, as an additional precaution, the contacting surfaces should be liberally coated with suitable jointing compound before assembly.

The dangers of introducing magnetic materials into the region of a compass should also be remembered. No magnetic material is alowed to be fitted within 18 inches of a compass and where repairs are required within

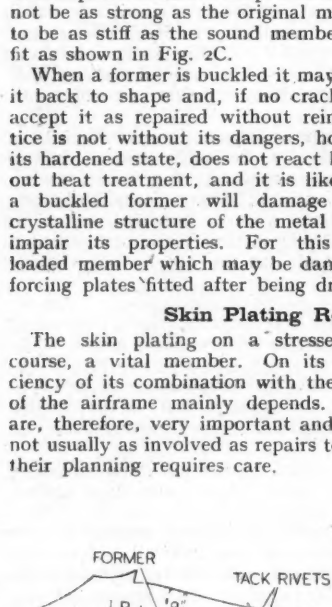


Fig. 3. Surface patching.

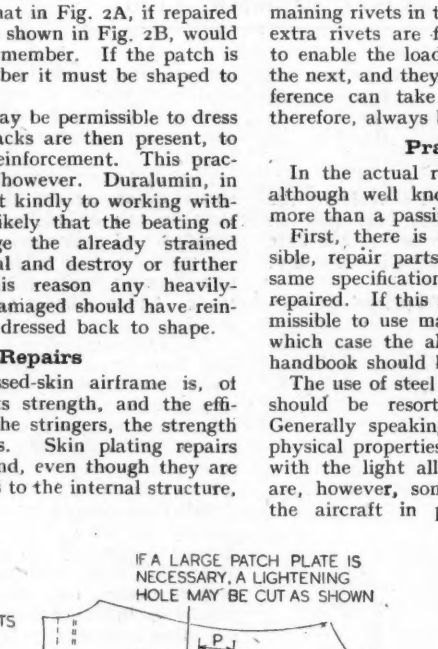


Fig. 4. Flush patching.

REPAIR OF STRESSED-SKIN AIRFRAMES

this region, only non-magnetic materials should be used, care being taken to ensure that the materials used are strong enough for the job.

Finally, there is the important precaution of unloading the structure before repairs are carried out. It will be realized that an aircraft standing on the ground is loaded, to some extent, by its own weight. It is true that the loads thus imposed on the structure are generally much smaller than the flight loads, but they are heavy enough to produce stress in the members. For instance, the wings of a four-engined aircraft may, when the machine is standing on the ground, have a downward deflection of some 6 inches at the wing tips, produced by the dead weight of the engines, tanks, fuel and wing weight. Similarly, the fuselage may sag between the front wheels and the tail wheel.

From this it will be clear that to attempt extensive repairs to a structure so loaded is asking for trouble. The affected section should be firmly jacked up so that all load is removed from the structure. Only then is it safe to remove any appreciable portion of the skin plating, and only in the unloaded condition can other members be repaired efficiently.

POTENTIAL VALUES OF VARIOUS METALS
(in sea water)

Metal	Value (volts)
Austenitic steels	0.20
Nickel alloy	0.23
High chrome steels	0.35
Duralumin	0.67—0.70
Ordinary steels	0.73—0.76
Cadmium plating	0.82
Aluminium	0.82
M.G.5 (magnesium alloy)	0.82
Zinc plating	1.13
Magnesium alloy	1.59

Preparing for the Brabazon

WITH an expediency reminiscent of wartime contracts, the work on the extension of Filton's east-west runway, for the "accommodation" of the Brabazon I, or Bristol 167, on its test flights, is already very thoroughly under way. The demolitions and levellings are being carried out at the western end of the runway—a fact which, though necessitated by local conditions, will have certain advantages, since the prevailing wind in the summer can be taken as blowing approximately from that direction and it will be better to start the take-off from the factory end. Even when the runway is completed, however, there will still be a good deal of undulation, with an initial sharp rise of ground at about the point when the 167 may be expected to be reaching something like take-off speed. Presumably, too, the original runway will need strengthening.

Although, as far as the necessary airfield alterations are concerned, stress has so far been laid on the development of the actual runway to be used by aircraft, an enormous amount of work will be necessary to provide a track along which the 167 can be towed to take-off position. Those who know Filton will remember that the aircraft works are on the side and at the top of quite a considerable hill, with the airfield at its foot, and the prototype 167 is being built in a hangar part-way up this hill. By eye it almost appears as if the completed aircraft will be immovable, since it must be turned and towed past the single central roof support and then turned again to avoid a building on the other side of the track. On the "hill" side of this building considerable excavation and tree-felling efforts will need to be made.

In point of fact the most careful calculations and experiments with models have been made to assure the constructors that all will be well when the time comes to tow the 167 to the runway, and we are assured that there are plenty of inches to spare, provided that all movements are carried out exactly according to plan. The aircraft will, of course, be completed on the stocks only as far as the outer engine mountings, and the wing extensions will be attached later. Nevertheless, aircraft construction has, with the 167, reached shipbuilding proportions.

During the past month or two the most surprisingly rapid progress has been made on the prototype. The fuselage structure is very nearly complete and the areas of skinning suggest that the finish even of the prototype will be quite exceptionally good. Although there is no sign yet of the power unit mountings, a Double-Centaurus unit has recently been undergoing full-scale tests at, from its sound, high boosts and much to the oral discomfiture of the occupants of the local offices. It must be admitted that the sight of the complete unit, with its two separately driven, contra-rotating, large-diameter airscrews flinging themselves round at the end of their gear box, is a very impressive one. Again, the long shafts from the two Centaurus have a distinctly marine look—one could almost imagine the flight engineer going round with an oil-can.

At the other end of the scale the Bristol-Hafner four-seater helicopter is also well on the way towards completion, and this prototype should certainly be flying before the end of the year. In the meantime, Mr. Pegg, the assistant chief test pilot, and another of his team, are gaining the necessary experience on a Sikorsky R-4.

HAWKER-SIDDELEY RESIGNATION

THE British aircraft community and indeed aviation circles all over the world, will be interested and probably surprised to learn that Mr. H. K. Jones has resigned from the Board of Hawker-Siddeley and its associated companies. No reason has been given for the resignation.

H. K. Jones.

We forget when, exactly, "H. K." joined the firm, but he was with the old Sopwith company, was at Kingston when the H. G. Hawker Engineering Company was formed, and has been a director of the Hawker-Siddeley group since its formation in 1935. Whatever the reasons for his resignation, there can be no doubt that "H. K.'s" shirt-sleeved energy will be greatly missed by many of his former colleagues. During the war he drove himself mercilessly, and we believe we are right in saying that he never missed a day's work the whole time. He is far too energetic to stay out of aviation, and we shall expect to hear of him popping up again before long.

MEMORIAL SERVICE TO G. de HAVILLAND

THE cathedral and Abbey Church of St. Alban is the scene of a memorial service to be held at 11.30 a.m. this morning for Geoffrey Raoul de Havilland, who lost his life recently when flying the D.H.108 jet-propelled research aircraft.

NEW BRITISH GLIDING RECORDS

A GENERAL meeting of all B.G.A. member and associate member clubs will be held on Friday, October 4th, at 3.30 p.m., at the Royal Aero Club. In the provisional agenda is included the appointment of a new chairman, since Professor Brunt has asked to be allowed to resign owing to pressure of other work. He will be acting as chairman at the meeting.

Meanwhile some new gliding records have been "homologated" by the Association. These are:

CATEGORY I (SINGLE-SEATERS).—*"Goal" Flight:* P. A. Wills, in Weihe, from White Waltham (Berks) to Leiston (Suffolk) on July 27th, 1946, 113 miles. *Height:* P. A. Wills, in Weihe, at Long Mynd (Salop) on June 23rd, 1946, 15,247ft. CATEGORY II (MULTI-SEATERS).—*Height:* Sqdn. Ldr. E. J. Furlong and Lieut. (A.) Johnson, R.N., in Kranich, at Peplow (Salop) on July 5th, 1946, 3,601ft. *Distance:* Lieut. Cdr. (A.) J. S. Sproule and Lieut. (A.) Suthers, in Kranich, from Peplow (Salop) to Owlswick (Bucks) on July 6th, 1946, 103 miles.

The heavily loaded Lockheed P2V takes off from Perth, Western Australia, with the assistance of rockets. It took a little over 4,600 yards to "unstick."

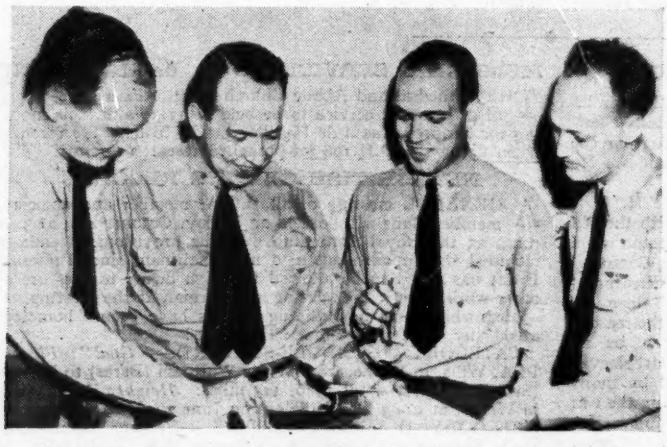
The New Long-distance Record

Lockheed P2V Naval Patrol Bomber Covers 11,236 Miles

IN flying non-stop from Perth in Western Australia to Columbus, Ohio, U.S.A., Commander Thomas D. Davies and his crew have established a new world's long-distance record for America and have brought great credit to themselves, the makers of the P2V and its two engines. The previous longest flight, from Guam to Washington, made last November by a Superfortress belonging to the American Army, was 7,929 miles. The new record of 11,236 miles raises the distance by no less than 3,300 miles.

The P2V, named the *Truculent Turtle*, took off from Perth, Australia, at 11.10 a.m. B.S.T. on September 29th and, following a Great Circle route, flew across Australia, the Pacific Ocean, and most of the United States via Alice Springs, Bikini, Midway and Seattle, finally landing at Columbus, Ohio, at 12.28 p.m. Eastern Standard Time on October 1st after being airborne for 55 hours 18 minutes.

Of the route and weather Commander Davies said that it had been a fine trip, but that they had met head winds right across the Pacific Ocean, and some icing just short of Seattle, but after that there had been a few hundred miles to Ogden, Utah, with terrific tail winds. He believed they could have continued on to Washington, but there would have been no reserve of fuel and the guages were proving inaccurate, so he had decided to play safe.

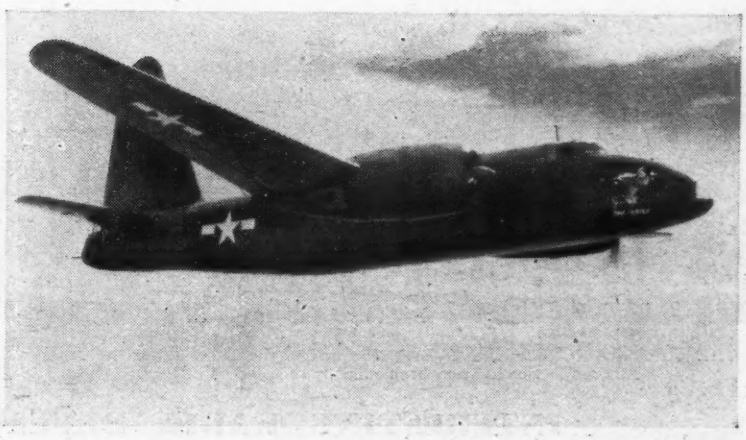


A crew of four flew the "Truculent Turtle" on its 55-hour flight. They are (left to right) Cdr. T. D. Davies, Captain and pilot; Cdr. E. P. Parkin, co-pilot; Cdr. W. S. Reid, second co-pilot and navigator; and Lt. Cdr. R. H. Tabeling, wireless operator—all of the U.S. Navy.

The aircraft took off with the assistance of three J.A.T.O. units. Even so, it required a run of about 4,650 yards. The fuel load is given as about 8,000 American gallons and an all-up weight on take-off of 85,500 lb has been mentioned. This figure, however, seems improbable, even with rocket-assisted take-off, as the maximum weight of the Lockheed P2V Patrol Bomber in its standard form with tankage for 3,500 miles is about 60,000 lb.

The crew of four, accompanied on the flight by a baby kangaroo for the Seattle Zoo, compares with the normal complement of seven, and noticeable modifications are the removal of nose armament and mid-upper turret. Wing-tip overload tanks were also fitted.

Pleasing and conventional lines characterize the well-proportioned mid-wing P2V.



In record trim the P2V patrol bomber has the mid-upper turret and nose armament removed. It is seen here on a practice flight without its wing-tip overload tanks.

The wing span is 100ft, the length 75ft 6in and the height 28ft 1in. A particular feature is the Lockheed-developed "Varicam" tailplane which embodies a mechanical device for varying the curvature of the horizontal surfaces in order to adjust trim.

Two Wright Duplex Cyclones giving a total of 4,600 h.p. are fitted. No further testimonial will be needed regarding their reliability and economy. Incidentally, they are very similar to the engines in Superforts or Constellations. On the P2V a particularly compact and clean installation has been achieved, the exhaust outlet being well to the rear on the nacelle sides.

During the time that Commander Davies and his crew were in the air, a U.S. Army Air Force Superfortress under the command of Col. S. C. Irvine was standing by at Hawaii to make the 10,000-mile flight to Cairo via the North Pole on an official long-distance record attempt. This, now completed, is reported on page 394.

The previous official world's long-distance record of 7,158 miles was set up by Sqn. Ldr. R. Kellett on a Vickers Wellesley in November, 1938.

TOWARDS GREATER FREEDOM FOR TOURISTS

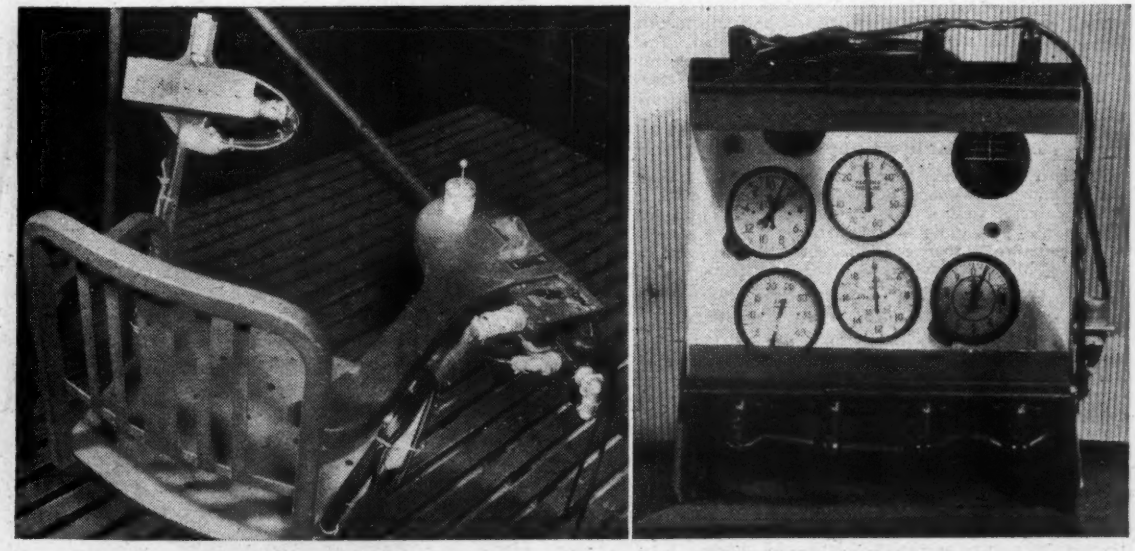
REPRESENTATIVES of no fewer than 41 nations were welcomed by Lord Hacking, chairman of the Travel Association of Great Britain and Northern Ireland, at a reception at the Savoy Hotel, London, on October 1st, to the delegates to the four-day International Conference of National Tourist Organizations held in the County Hall, Westminster.

The attendance at the conference, he said, was clear evidence of the world's interest in the development of tourism, and while they could not settle all the problems in a week, they could by frank discussion go a long way towards arriving at agreement on many vital subjects.

On October 3rd the delegates were the guests at a luncheon at the Dorchester Hotel, London, by British Overseas Airways, British South American Airways, and British European Airways. Lord Knollys, in welcoming the guests, emphasized the fact that air operators and tourist organizations shared the wish to have restrictions eased or abandoned. In air travel this was even more important than in other forms of transport in which the time taken up by formalities was but a small percentage; in a flight to Paris it might amount to 100 per cent. At present the airline companies carried their passengers at some 250 m.p.h. In years to come that speed would go up to 400 or even 500 m.p.h., and it was essential that the whole tempo of travelling should be on the same kind of scale, otherwise the high speed would be wasted.

Mr. T. Dunbabin, Australian delegate, spoke very amusingly, but in more serious vein pointed out that the many restrictions, passports, visas, etc., were merely an irritation to travellers, and did no real good, as they provided no safeguard.

TEST PILOT'S STAND-IN



The U.S. Navy has evolved some interesting equipment for controlling high-speed aircraft by radio and for recording test data. The left-hand view above shows the "pilot's" control gear. It appears that the master controls are to his right; the buttons to the left operate the undercarriage and elevators, select fuel tanks, cage the gyro and control r.p.m. The right-hand view shows the instrument panel in a "drone" Tigercat; this is mounted opposite a television camera and readings are transmitted to a room below the "pilot's" position.

CIVIL AVIATION NEWS

Future Radio Aids: Traffic Control Statement: "Journey-breaking" Tickets

THE CORPORATION TAKES OVER: The first of the Tudor Is for the Trans-Atlantic service has now been officially accepted by B.O.A.C.

INTERESTING RADIO DEVELOPMENTS

P.I.C.A.O. Delegates See Something of the Future at Farnborough

MALVERN, Bassingbourn and Farnborough will undoubtedly be long remembered by P.I.C.A.O. delegates and observers, but whereas the trend of development of particular equipment and systems was demonstrated at each establishment, it was Farnborough that probably provided more food for thought on the potentialities of radar and radio aids of the future.

Whilst providing, perhaps, rather less accurate information than the devices demonstrated at Malvern, the Farnborough equipment was almost invariably more attractive to some users by virtue of its compactness, light weight, and economy. Many items which are at present only in the development stage and are regarded almost as novelties, will eventually become most acceptable to airline operators and, in some cases, private owners.

Although described as a "toy," perhaps one of the most useful devices was the VHF rotating beacon. Its particular application would be for an airport situated in country without distinguishing landmarks or on an island. Working on a frequency of 112 to 115 Mc/s, a comparatively small beacon rotates and announces in plain language during its 360 deg. rotation, the magnetic bearings at 20 deg. intervals. Between the bearing announcements the code letter or name of the airfield is transmitted. The only aircraft equipment required is a VHF set with the necessary channel.

A pilot can home to within 5 degrees either side of the bearing received, and this is sufficiently accurate to bring the aircraft to within a quarter of a mile of the airfield. The range is approximately 80 miles at normal flying heights, and there is no limit to the number of aircraft which may use the device at any time. The great advantage to the private owner is that no transmission is necessary.

Lightweight VHF.

Standard Telephones have produced a VHF transmitter/receiver known as Type STR.9 which weighs only 22lb, excluding the cables. The set using 22½-29 volts D.C. measures only 16½in × 9in × 7⅞in, and the control box 2⅜in × 3½in × 2⅝in. Its compact nature is therefore apparent. A frequency band of 115 to 145 Mc/s is provided and four spot frequencies may be obtained with a one-switch selector, fully controlled from a remote point. This is another useful piece of equipment for light aircraft.

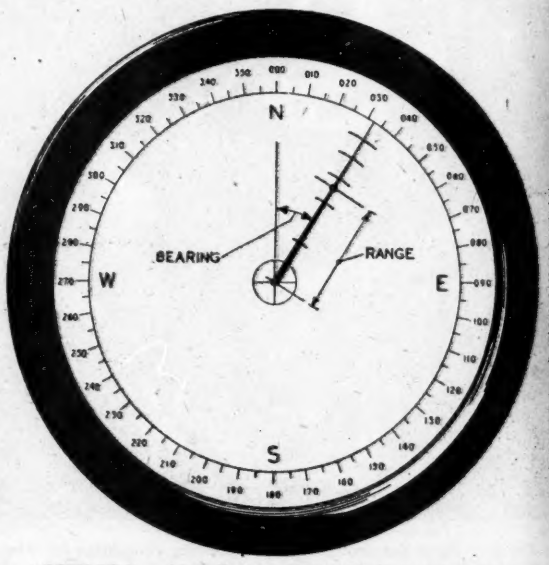
The same company have developed a combined direction and range finder for aircraft transmitting on VHF. Known as the Condar system, it provides what is virtually a plan position indication of any aircraft in communication with the control tower.

An aircraft in VHF R/T communication causes a radial line trace to be displayed on the screen of the cathode ray tube. At the same time a modulated signal from a VHF ground transmitter, tuned to a different frequency, is received in the aircraft and transferred to the carrier wave which is being transmitted to the ground. The phases of the modulations on the received and transmitted signals are compared automatically, and phase difference is a measure of the range of the aircraft. Since the trace indicating the bearing is synchronized with the range-finding modulation, the result of the comparison can be displayed on the trace as a bright spot, its distance from the centre of the screen being a measure of the range.

The range is read off at sight by means of a luminous scale of miles marked electronically on the radial bearing trace. For aircraft not equipped with Condar the equipment functions as an automatic direction finder. The range is in the neighbourhood of 100 nautical miles for aircraft flying at 10,000ft. At greater distances the indication becomes ambiguous. This single automatic display of bearing and distance, combined with immediate aural identification, naturally provides very rapid position indication.

One of the recommendations of C.E.R.C.A. was that an air-sea rescue chain should be created. The Marconi company have produced a direction finder with twin channel facilities and instantaneous visual bearing presentation. The system provides for one operator to maintain continuous watch on any two frequencies in the band by the use of split telephones. Both earpieces may be concentrated on either receiver when necessary. The direction finder gives bearing indication on the screen of a cathode ray tube by the spinning-radiogoniometer method, and either receiver may be switched for visual display. The system is intended for distances exceeding 500 miles and the range is virtually unlimited. Whilst keeping a constant listening watch on a given operating frequency the operator can at the same time listen out on the emergency frequency, and upon receipt of an SOS take an immediate visual or aural bearing.

It is obvious that there would be several advantages if the

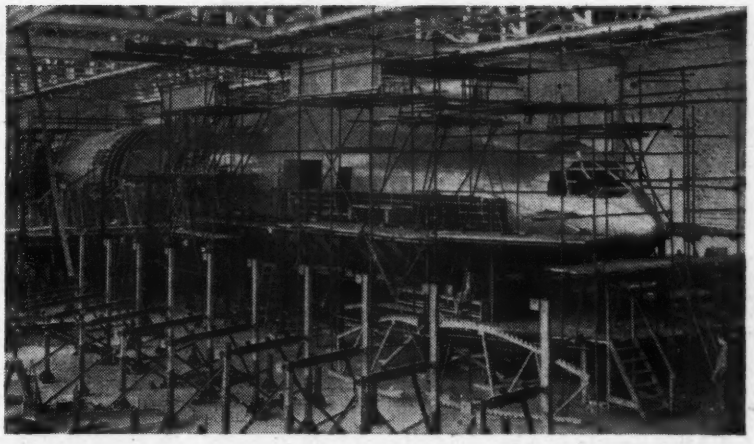


"CONDAR": A single automatic display of bearing and distance is seen on the cathode ray screen in the new Standard Radio navigational system. The range is marked electronically on the radial bearing "trace".

CIVIL AVIATION NEWS

present R/T or C/W communication system used in civil aviation could be replaced by some automatic signalling system. For example, the language difficulties would be removed and there would be an increase in the reliability and accuracy of air-to-ground communication. A signalling system can never be as flexible with regard to information that is transmitted as a system using R/T or C/W morse; however, using a suitable code it is possible to pass sufficient information for control and weather reports to cover normal requirements.

An automatic system under the name of Impulse Signalling has already been constructed and was in fact used by the R.A.F. Fighter Command during the later stages of the war, but the number of available characters was limited and the speed of transmission slow. A new system is being developed which overcomes to a degree some of these limitations. It works on the following principle: A signal consists of a constant number of double tone impulses, the first and last of which are double the length of the remainder. Within the spaces thus created are other double tones forming the units of intelligence of the signal. Each unit is arranged to position the corresponding disc in an indicator unit so as to display the character through a fixed window and each disc has forty effective positions. Discs are selected in turn by sequence selection and the position of each disc is selected by direct selection. By the reservation and suitable application of the intelligence carried in the first two spaces, any particular indicator can be made to respond only to a particular combination or call sign. The transmission equipment consists of a control unit incorporating a display of the outgoing message and a modulator unit. The message is sent by depressing keys on an illustrated keyboard; and acknowledgment is indicated automatically by a green light. A message received in corrupt form by an aircraft would not be acknowledged. The message may be sent to a single aircraft, or to any number simultaneously. It is believed that a communication system could be developed enabling messages to be passed with greater speed and efficiency than could be achieved by R/T or morse, and with greater reliability and accuracy of transmission.



TAKING SHAPE: The work on the first of the two Brabazon I's, or Bristol 167 prototypes, is progressing very rapidly—as this recent photograph shows. An immense amount of development work will be necessary on this and the second prototype before the 167 can be put into service; its first flight will be merely the beginning.

The principle of SCS.51, blind approach and landing system which was described briefly in *Flight* dated September 19th, has been adopted and improved by Pye, and an electronic modulator on the 90 and 150 Mc/s frequencies has been substituted for the mechanical modulator. The glide path antenna design has also been improved, giving fewer minor lobes.

It is well known that precipitation static interference is a serious menace to radio communication with aircraft, and even interferes occasionally with ground installations. Corona discharge into the atmosphere is the cause of the interference, and produces electrical noise which becomes coupled into the aerial circuit. When flying in dust storms or ice clouds, an aircraft could charge up to a potential of a million volts with a field gradient of several thousand volts per centimetre near the aerial. The aerials may now be insulated to prevent corona forming, and comparative freedom from precipitation static troubles is achieved. The greater diameter of the aerial wire may, however, cause icing trouble.

Orb is the name given to a homing device which permits selection on a dial of a desired direction of approach. An independent pointer indicates the correction necessary to find that course. This system could be particularly useful in mountainous districts.

The new flying control tower at Farnborough contains a plotting table on which a constant watch is kept of the progress of all aircraft under control. Another interesting feature is the Optical Angulator. An operator receives W/T bearings from three different ground stations which when set on dials are each displayed through a map of the area by beams of light radiating from the stations, and a fix is immediately provided by the intersection.

The occasion of these demonstrations was obviously not suitable for an exhibition of other flying safety measures and devices, but it would be interesting to know about the developments in flying instruments. A more reliable and more quickly responding artificial horizon would be a useful contribution to flying and to which radar might be applied.

B.E.A. GIRL: The new uniform to be used by B.E.A.'s stewardesses and traffic clerks which will be first seen at the Paris Exhibition. The colour is grey—as opposed to the more usual airline navy used in the B.O.A.C. design.

BREAK OF JOURNEY

BRITISH EUROPEAN AIRWAYS have announced that passengers will be permitted to break their journey at intermediate stops when holding through tickets. It is a prerequisite, however, that passengers must state their require-

CIVIL AVIATION NEWS

ments when the reservations are made, and it is their responsibility to reserve accommodation for succeeding stages. An entire through ticket must be purchased at the time of the initial booking. The conditions which govern cancellations of reservations have been amended. Instead of twenty-four hours', forty-eight hours' notice is now required before the scheduled time of departure. If a cancellation is made within the forty-eight hours and the service is fully booked, no refund will be allowed unless the seat is resold. It is understood that although B.E.A. have no service which terminates at Bordeaux, it is possible to fly there on the Madrid, Lisbon and Gibraltar services, if the number of through bookings will permit. In order to avoid displacing through passengers, therefore, bookings to Bordeaux cannot be confirmed until shortly before departure. Previous experience has shown, however, that normally accommodation is available in both directions.

MINISTERIAL STATEMENT

THE Ministry of Civil Aviation issued the following announcement on October 1st, 1946:

"A number of misleading statements have been made recently about air traffic control in the London area. The facts are that the system of air traffic control in force at the London and Northolt Airports is in line with the most up-to-date anywhere in the world to-day. Although no one can say of airlines, any more than railways, that accidents will not happen, the public may rest assured that no practice which is not compatible with the utmost possible safety is tolerated in the London area, or, indeed, at any British commercial airport.

Co-ordination of the control at the London and Northolt Airports has been developed steadily during the past year. Further improvements in the traffic pattern are about to be made as a result of consultations during recent months with the operators and the British Air Line Pilots' Association. The fact that closely situated airports can be operated with perfect safety and without interference has long been demonstrated in the United States. Further, the number of aircraft movements per day in the London area is not allowed to build up beyond that which can be handled safely in the weather prevailing.

At present an average of only 50 arrivals and departures per day is being maintained at the London and Northolt Airports, giving a total of 700 movements per week for the two airports together. This figure compares with more than 1,000 movements per week which have been handled successfully at Croydon for long past. It contrasts also with more than 2,450 movements per week at such airports as New York and Washington in the U.S.A.

Statements have been made that wartime radar aids have not been applied to civil airport control—to the disadvantage of civil aviation. Although there can be no doubt that development in the field of radar and radio will materially improve air traffic handling methods in the future and will make possible a greater number of arrivals and departures in worse weather than can be handled to-day, nevertheless, methods evolved directly for wartime needs, where the high standards of safety demanded for civil aviation had to take second place to operational requirements, cannot be applied to civil aviation without much development.

There is much public misunderstanding about the meaning of radar and about the ways in which different radar techniques can serve civil aviation. Although some radar aids to instrument approach already exist at the London and Northolt Airports, and others are in process of installation, radar for air traffic control is just emerging from the experimental stage and as yet is installed at no civil airport in the world. The United Kingdom is well ahead in its preparations for such use of radar in the future.

A demonstration of projected British radar aids for civil use was held in England in September. A corresponding demonstration of American aids is being held this month. The technical issues raised are to be determined by the Provisional International Civil Aviation Organization at Montreal in November with a view to reaching essential international standardization.

In the interim the London and Northolt Airports are being equipped with suitably modified military radar aids as an additional safety check on standard radio navigational aids. The problem is largely that of getting supplies of new equipment, much of which has had to be specifically designed to serve the needs of civil aviation. Until radar and other devices are available to make possible landings in lower visibility than at present, the British policy remains that aircraft will be diverted to other airdromes when safety demands it. The number of diversions and cancellations that are likely has, however, been greatly over-estimated in some quarters.

The British Airways Corporation, as the record shows, make the safety of passengers their prime consideration. Air traffic controllers are instructed that diversions should be made whenever the weather is such as to create any doubts on safety.

In all these matters the Minister of Civil Aviation is fortunate in that he can rely for objective technical advice on Sir Robert Watson-Watt (Chief Adviser on Telecommunications), who has been the leading British exponent of radar, Air Chief Marshal Sir Frederick Bowhill (Chief Aeronautical Adviser), formerly C.-in-C. R.A.F. Transport Command, and Air Vice-Marshal A. C. Collier (Director-General of Technical Services), formerly Deputy A.O.C.-in-C. Transport Command. The experience gained in war is, therefore, at the disposal of the Ministry for purposes of peace."

The statement ends with a list of radio and radar facilities either now available or in the process of installation at London and Northolt Airports.

LONDON.

M.F—D/F.		H.F—W/T and D/F
H.F—R/T.		VHF—R/T and D/F.
Eureka Responder Beacon.		
SCS.51.	SBA.	Gee Cover.
BABS Mk. II in process of installation.		
ASV. Responder Beacon in process of installation.		

NORTHOLT.

M.F—D/F.	Eureka.	SBA.
H.F—W/T and D/F.	Radio Range.	Gee Cover.
H.F—R/T.	M.F Beacon.	
VHF—R/T and D/F.	BABS Mk. II.	

OPERATING COSTS

THE International Air Transport Association have formed a special committee to analyse airline operating costs as a basis for international air transport rates throughout North and South America. The committee is one of six set up by the Western Traffic Conference which met during September in Brazil. This Conference represents one of the nine regional groups through which airlines represented on the I.A.T.A. are attempting to achieve safety, and uniformity in rules and conditions of air transport.

Standard traffic forms, tickets, weigh bills and baggage checks have been prepared, and it is proposed to recommend standard conditions of carriage, tariffs, rates and schedules for the international routes in the Western Hemisphere. Committees have been formed to deal with Government forms, conditions of carriage, reservations and agencies, and the items already mentioned.

BREVITIES

B.O.A.C. are exhibiting for a further week the art and industrial display which was originally staged at the Dorchester Hotel on September 18th. The exhibition is open to the public at the Corporation's showrooms, 75, Regent Street, London, W.1, until October 12th, from 10 a.m. to 6 p.m.

* * *

Mr. Juan T. Trippe, President of Pan American World Airways, has been presented by the United States Government with the Legion of Merit, the highest civilian award. The award was presented as an acknowledgment of the way in which Pan American Airways "contributed directly and effectively to every major campaign in which the U.S. Forces were engaged."

Zurich has so far been the Swiss terminal for the B.E.A. scheduled service between the U.K. and Switzerland. This is run by charter arrangement with Skyways, using Dakotas or Yorks at their own discretion. Owing to frequent unserviceability of this airfield, the service is now being run to Geneva.

* * *

The American Civil Aeronautics Board have estimated the cost of reckless flying in terms of planes lost and damaged to exceed $250,000 during the past twelve months. This does not take into consideration the cost in lives and other losses which cannot be measured in terms of dollars. The Board warns those who indulge in premeditated recklessness that they are liable to heavy penalties.

The Status of Civil Aviation in 1946

Conclusion of Sir Henry Self's Paper before the R.Ae.S.

(Continued from page 372, October 3rd)

Aircraft Research, Development and Production

Because of the great potentialities of aircraft as a weapon of war, governmental interest in design and production in the past had tended to be centred primarily on military requirements. In the period between the two World Wars, Government support and encouragement of the development of civil aircraft was sporadic, and there was no serious governmental attempt to create and build up a civil branch of the aviation industry until the Cadman Committee indicated the probable results of past neglect and strongly recommended State assistance to encourage the development of suitable types of civil aircraft.

Unfortunately, war broke out before any tangible results could flow from these measures. The outbreak of war necessitated the suspension of all aircraft purposes, and also of almost all transport aircraft production in the United Kingdom and throughout the Commonwealth. The resultant shortage of transport aircraft created immense difficulties for civil as well as military aviation. These difficulties were both short-term and long-term.

Looking at the more distant prospect, reports were received from across the Atlantic of the great progress being made in America in the design and production of new transport aircraft. There was every prospect that America would have a commanding lead in this sphere at the end of the war. It was well known that this flowed in large part from an understanding which was reached early in the war between the British and American Governments that Britain would concentrate on the production of fighter and bomber aircraft while the U.S.A., in addition to their great military programme, would be responsible for supplying the transport aircraft needs of the Allies.

Experience both here and in America had shown that a period of at least five years will normally elapse from the date when the requirement for a new large civil air liner is first started until the date when it comes into service. Thus, there was no time to be lost. It was decided, therefore, to appoint a Committee under the chairmanship of Lord Brabazon of Tara.

By about 1950 the majority of the converted and adapted types should have been replaced in service with the Corporations by the new purely civil types that were being developed to-day. But we must not rest content at that. During the next four years we must be planning and laying the foundations of the aircraft fleets that would be required in the 1953-56 period to replace the present Brabazon and other types which would be the mainstay during the 1950-53 period. It was very difficult to forecast the operational requirements and traffic trends of ten years ahead, and this difficulty called for bold decisions within the next year or so, if we were to be in the van of aircraft progress in the mid-nineteen-fifties.

The Financial Picture

It would, Sir Henry continued, be helpful to consider, first, what we meant by "self-supporting." The unpremeditated answer might be "operating with government subsidy," but, before accepting this statement, we must decide what we meant by "government subsidy." Right down to the present day, there had been some form of government subsidization in every air transport operating country. The most common forms of subsidization had been:

1. Direct financial payments;
2. Air mail payments exceeding the economic rate for the work done;
3. The provision of navigational facilities;
4. The provision of airport facilities;
5. The provision of aircraft;
6. Taxation concessions;
7. The financing of aeronautical research and development.

The nations of the world have agreed that these practices must end. Costs were high because (i) equipment was undeveloped and relatively inefficient and (ii) demand at economic prices was limited. Demand was small because (a) acceptance of the new mode of transport was slow; (b) costs were high; (c) collective demand, e.g., for better communications, was latent and inarticulate. In fact, the growth cycle, if not given outside impetus, might tend to be a vicious circle of stagnation.

British airline operations were at present in a transitional stage. New services were being started, existing services increased, and new types of aircraft introduced. Organization and methods adopted for war purposes but inappropriate for fully civil operations, were being reshaped for peacetime working, and the whole operating structure was being regrouped. Operating costs were, therefore, in a similar state of flux. It was certain, however, that with a restoration of operations to a peacetime commercial basis, the introduction of the new and more efficient types of aircraft now coming along, and, particularly, with a general substantial increase in the utilization of resources, costs would come down considerably.

On this basis the indications were that the aircraft available in the early 1950s should be capable of operation at fares of 2½d to 3d per passenger-mile. On the Empire and Atlantic routes, it should be possible to obtain a higher utilization than on the U.K. and European routes, amounting in some cases to 3,000 or more hours per year. Fares, based on cost, of the order of 3½d to 4d per passenger-mile would appear to be capable of achievement within a reasonable time. A fare of 3½d per mile worked out at about £14 per thousand miles, yielding typical fares of about £50 single to New York, £100 to South Africa or South American and £150 to Australia.

The Psychological Reaction of Humanity

Sir Henry then spoke on public interest in air transport, a subject he thought to be of the utmost importance. Viewed, he said, with perfect candour there could be little question but that, before the recent war, there was on the whole a fairly widespread indifference in the Eastern Hemisphere to air transport services and their possibilities, except for the visionaries, the more enterprising travellers and, in the ranks of businessmen, those who saw value in the saving of time.

It was true, he said, that this stage had been passed in the United States where real scope existed for a network of air services meeting the needs of a large population scattered over a widespread area. Great saving of time and regularity of services at cheap costs were practicable because of the exceptional geographical advantages which that continent offered. The result had been that a large proportion of the community had become very much air-conscious and acquired the habit of using the air services provided. But even there it would be idle to suggest that there had yet developed a mass consciousness.

That in itself would necessitate a very carefully planned movement to get the public rightly and genuinely interested in the possibilities of air travel. Apart from that sub-conscious distaste there would, in so far as one could estimate from the pre-war years, still linger a definite indifference among the masses of the people. They were proud of the achievements which had been made and interested in the technique whereby great advances were revealed and new possibilities opened. But there seemed no reason to believe that they had ever thought of it as applying directly to themselves or affecting their own lives. They still preferred to look to the customary surface means of transport as normal and implied by their attitude that anyone who travelled by air was a bit out of the ordinary.

Sir Henry emphasized the need for a full and careful analysis of the reaction of the ordinary man in the street to the development of air transport, and even further emphasized the possibilities for international understanding and achievement of human aspirations by opening up that great vista of air travel for the people at cheap rates.

Conclusion

In conclusion, Sir Henry made an assessment of political and national trends, because of the great importance which he felt was attached to that appreciation of the position adopted by the United Kingdom in the development of

(Continued at foot of page 405)

Why "Centrifugal" Force?

Misnomer which has Caused Much Confusion

By G. D. DUGUID*

IT is common practice in aeronautical engineering to speak of centrifugal superchargers, centrifugal pumps, centrifuges, etc., and it is a great pity that this term has crept into common usage, as it is actually a misnomer.

Derived from the Greek "kentron"—"centre," and Latin "fugio"—"fling," it literally means "flung from the centre," and has given use to statements such as "flung outwards by centrifugal force."

It is quite impossible for a body moving in a circle to be flung outwards, as the body cannot exert a force on itself, and there is no force acting to fling it outwards. The statement made above is, therefore, not only inaccurate but leads to considerable confusion of thought.

The actual state of affairs, of course, is that, to maintain the body in its state of circular motion, a force must act to accelerate it towards the centre of the turn, and this force is often the resultant of the weight of the body acting vertically downward, and the inclined reaction of whatever is constraining the body in its circular path, e.g., the reaction of the air in a banked turn in the case of an aircraft, the rails in the case of the locomotive, or road camber in the case of the motor car.

This central or centripetal force towards the centre varies as the square of the velocity, and inversely as the radius of turn, e.g., it increases as the turn becomes tighter, which is common knowledge.

If this centripetal force ceases, or if the constraining medium cannot exert sufficient force, then the body will obey Newton's first law, and continue its motion in a straight line, which will be a tangent to its original circular path, and not radially outward. Visual evidence of this is afforded by the rain drops leaving a windscreen wiper, the paths forming perfect tangents to the arc of the wiper.

To the aircraft pilot or car driver, a side-slip appears to be outwards from the centre of the turn as he himself forms part of the turning system, but to an external observer the aircraft or car is continuing to move forward in a straight line, and ceases to continue in the turn.

There is, however, an outward force, and that is the reaction of the body against its constraining medium, but this is a force acting on the constraint, and not on the body, and it is this force which is called centrifugal force.

Confusion is worse confounded by the writers of engineering text books, who will persist in stating that a body is in equilibrium under the action of three forces: the weight, the inclined reaction, or tension in a link, and the centrifugal force acting *outwards*.

As it stands, this statement is little short of nonsense, and it is seldom explained that a device has been resorted to. This device is to reverse the centripetal force, and *assume* it to act outwards, and consider the system to be in equilibrium, and, therefore, static.

The moving or dynamic system is not in equilibrium since it is under the action of a resultant force causing acceleration. The device is adopted as a convenience in machine design, where the stressing of the connecting link is the important factor, but unless it is clearly realised that it *is* a device, hopeless confusion results.

Units

An even greater confusion appears to exist regarding units, particularly with engineering students, who perforce must work at various times in three systems of units, namely, the absolute system, the Perry or "slug" system, and the engineer's system of units.

The "slug" system is convenient for some purposes, particularly aerodynamics, where density may be expressed in slugs per cubic foot. The slug, however, is only a compromise, and was introduced by Professor Perry as a mass unit 32.2 times greater than the pound mass, in order to obtain a force unit in pounds weight, instead of poundals. To be consistent, however, all pound masses (so-called) should be recalled and re-issued stamped "1/32 slug," in which case no confusion could arise between the slug and the pound.

Where the confusion arises with engineer's units, however, is that it does not appear to be generally realised that the engineer is thinking solely in terms of weight, and not in terms of mass. The fundamental units of the absolute, and Perry (slug) systems are length, mass and time, with force as a derived unit.

In the engineer's system the fundamental units are actually length, force and time, and this issue appears to be burked by most engineering writers, presumably on account of the fact that the lb weight is a gravitational unit and will not remain constant, but will vary with the value of "g."

The unit of force, however, can be made constant by specifying the place of weighing, namely London, standardizing the value of "g" as 32.2 ft per sec/sec. The unit of force then becomes the lb weight, measured at London.

In the engineer's system, mass is now a derived unit, namely W/g, where W is a force (lb wt.) and "g" is the acceleration of gravity. Provided the local value of "g" is used where the weighing takes place, mass will remain constant, but if 32.2 ft per sec/sec is used (London value) mass will not remain constant unless the weighing is carried out on or near the parallel of latitude passing through London, e.g., 52 deg N. The amount of error involved in the mass if weighing takes place elsewhere is less than one half of 1 per cent, which is negligible for all practical purposes.

W/g represents the only definition of mass recognized by the engineer, and is a definition of mass through its property of "inertia," the form in which the engineer normally meets it.

In the engineer's system, as mass is a derived unit, it must contain time, and this is not incongruous as it is in line with the modern conception of atomic energy, in which mass and energy are equivalent, and matter may be converted into energy and vice-versa.

It is sometimes stated that Moment of Inertia cannot contain a time unit, and it cannot, provided that mass is being used as a fundamental unit. In the engineer's system, however, it does contain a time unit, and the unit commonly used for Moment of Inertia is the lb.ft.sec.²

The confusion really arises from the fact that what the engineer calls a "one pound weight" is called by the mathematician and scientist a "one pound mass."

The Perry or "slug" units and the engineer's units give the same numerical results, but the quantities are expressed in terms of different units, and provided this is understood no confusion should arise.

* The Author is Senior Master at the Chelsea College of Aeronautical Engineering.

FORTHCOMING EVENTS

Oct. 12th.—Helicopter Association of Great Britain; "Historical Review of Helicopter Development," R. N. Liptrot, Manson House, 26, Portland Place, London, W.1.

Oct. 12th.—R.Ae.S. Portsmouth branch; dinner-dance, The Academy, Elm Grove, Southsea, 7.30 p.m.

Oct. 15th.—R.Ae.S. Graduate and Student Section; discussion on wing design (part 2), 4, Hamilton Place, W.1., 7.30 p.m.

Oct. 17th.—"Aerotech" Flying Club No. 1; "Bird Flight and the Aeroplane," Capt. J. Laurence Pritchard, Fairey canteen, 8 p.m.

Oct. 22nd.—R.Ae.S. Belfast branch; "Civil Flying Boat Services," Capt. R. C. Parker, B.O.A.C.

Oct. 23rd.—Royal United Services Institution, Whitehall; "The Luftwaffe and its Failure," A.V-M. Sir Thomas Elmhirst, 3 p.m.

Oct. 23rd.—R.Ae.S. "The Problem of Blind Landing," H. F. Pritchard, I.C.E., Gt. George St., 6 p.m. (tea, 5.30 p.m.).

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

LANDING FEES

A Reasonable Explanation Still Needed

PERHAPS one of your readers may feel equal to suggesting a reasonable explanation for the imposition of landing fees at State-controlled airfields?

It is understood that the official justification advanced for the recent heavy increases is the need for meeting the costs of airfield maintenance and its associated services, but does this bear scrutiny?

To take a parallel instance, is such a levy imposed on the motorist whenever he takes to the public highway? Are not the costs of road upkeep met from the proceeds of the petrol tax, which, incidentally, is paid alike by all petrol users, regardless of the manner in which it is employed?

Is there any reason why the tax on aviation spirit should not be applied for the benefit of aviation instead of being misappropriated into the Road Fund?

Civil aviation would then stand a chance of becoming really self supporting and the question of subsidies would never arise.

LET THE PEOPLE FLY.

[Without in any way defending the landing fees, we cannot agree that the position of the motorist and the public highway constitutes a parallel case—the public car-park would surely be nearer! Nor is it fair to say that the tax on aviation spirit is "misappropriated into the Road Fund." Indeed, it has long been the complaint of motorists that large sums are filched from the Road Fund for other purposes, thus retarding overdue road improvements. Motoring and aviation are more in the nature of fellow sufferers than Road Fund rivals.—ED.]

SIMPLIFYING NAVIGATION

A Multi-Beacon Suggestion for Universal Application

IT is extraordinary that, even with the present knowledge of radio at our disposal, air navigation should still be such an extremely complex matter, involving the employment of hundreds of experienced navigators, of beacons of different varieties and vintage, and of all the varying devices to which we have become accustomed.

I think radio navigation should be a very simple affair involving the least delay in the ascertainment of position at any particular instant, and providing the pilot automatically with as much information as possible. Moreover, the visual indications or "display" should be such that the pilot can reach a transmitter by following any predetermined route or, alternatively, can arrange his own approach corridor from any point of the compass. He should be able to co-ordinate his cross-country flight merely by switching over to the appropriate frequency channel and listening to the guiding indications, or, by watching a simple display on the cathode-ray screen, he should, without further action, be able to learn instantly and automatically his range, bearing and position in relation to the transmitter and the surrounding terrain.

In order to provide these ideal results, my idea would be to install a number of special beacons at various carefully planned points in the particular area to be covered. Each of these beacons, by utilizing modulated pulse transmissions, would give four approach corridors, each one to two degrees wide, with, between them, four easily identifiable sectors. Continuous information would be transmitted on R/T in each of these sectors, this information including the identity of the sector, the name and grid reference of the beacon, the prevailing barometric pressure at the particular station, and any other information at the discretion of the Traffic Control Officer. In addition, the beacon would indicate, to any aircraft fitted with cathode-ray tube indicators, the true bearing and distance of the aircraft from the beacon, and a pin-point position in relation to the surrounding terrain. The crew of a well-equipped aircraft, therefore, would have the choice of flying along one of the four approach corridors, or of organizing their own navigation from the information provided.

Such a beacon would consequently be of assistance not only to the more elaborately equipped aircraft, but also to smaller machines capable only of carrying a communication receiver. With the last it would be possible to obtain all essential information, and, using any two such beacons, the pilot's position could be worked out in a matter of five or ten seconds.

By the suitable positioning of, say, twelve of these inexpensive, low-powered beacons at carefully chosen points in the British Isles, a navigational grid system would be possible. Such a suggested layout of beacons is shown in an accompanying illustration. By following any of a series of selected "tramlines," an aircraft with a radio receiver could always reach its destination.

It would be a comparatively simple matter to develop a combined system for approach and ground control—in fact, the suggested beacon, with pulse modulating technique, has been designed with that special object in view.

R.A.F. Station, Topcliffe, Yorks. F/O. D. N. SHARMA, B.Sc.

RANGE OF THE SPITFIRE

Official Data on the Mark 24

WHILE looking at the really excellent photogravure illustrations in *Flight*, September 12th, I was surprised to see a claim on behalf of the Spitfire "24" of a range of 860 miles without drop-tanks.

Although my personal experience of "Spits" finished (alas!) with the Mark VB, I cannot imagine how the extra tankage has been squeezed into that "tailor-made" fuselage. I believe the main-tank capacity of the "Five" was 85 gallons, and in the later Griffon-engined types the capacity was increased by 12 gallons.

Assuming the following figures of speed and consumption for the "24" (in which, to be on the safe side, I have leaned rather towards the optimistic):—

Maximum weak-mixture cruising 380 m.p.h. at 22,000ft.
Petrol consumption ..... 93 gallons per hr.

Even if the range quoted is intended to be an "optimum cruising" figure (usually an idealistic one!) I just cannot get beyond about 550 miles (the operational radius of Mark V *with* drop-tank, by the way).

In view of the fact that the only drawback to the work of the war's greatest single-seater fighter (vide any "Spit" pilot!) was the limitations of its range, I should like to hear if any of your readers could provide a little "gen" on the subject?

J. C. ELKINS.

[Vickers-Armstrong, Ltd., give the following particulars on the Spitfire 24:—Capacity of fuel tanks: fuselage top front 36 gal., bottom front 48 gal., rear 66 gal., wing 36 gal., total 186 gal. Range on this internal fuel is 580 miles at 20,000ft allowing for take-off, climb to 20,000ft, and 15 min at combat conditions.—ED.]

THE STATUS OF CIVIL AVIATION IN 1946

(Continued from page 403)

civil aviation. Against that background it was submitted that the U.K. plan offered genuine possibilities for:—

(a) Free individual enterprise in all air activities outside the reserved region of scheduled air services;
(b) The development of U.K. air transport services through the agency of three "Chosen Instruments."
(c) The United Kingdom arrangements for close collaboration with other members of the British Commonwealth in the further development of Commonwealth air services was sound family policy within the setting of the wider orbit of the United Nations.
(d) The planning towards the ultimate entrustment of world air services to an international organization, whilst contriving that regional air services would be operated by national carriers in pursuit of legitimate national interests—but always within the co-ordinating machinery of the regional organizations under the direction of the International Civil Aviation Organization.

The whole of that policy and those plans were broadly conceived within the spirit of the new world which was beginning to take shape. It was hoped that such a policy would commend itself increasingly to the other nations of the world. In the meantime, Sir Henry continued, we were confident that the scheme would give best expression to the British spirit and enterprise within an ordered plan, giving maximum opportunity for development of United Kingdom air services on the right lines while always keeping the road open to the international goal.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

Awards

THE KING has been graciously pleased to approve the following awards:—

Additional Members in the Military Division of the Most Excellent Order of the British Empire.

Flt. Lt. JOHN WILLIAM BEST, R.A.F.V.R., No. 39 Squadron.
Flt. Lt. JOHN RICHARD DENNY, D.F.C., R.A.F., No. 78 Squadron.
Flt. Lt. RONALD ALFRED GEORGE ELLEN, R.A.F., No. 82 Squadron.
Flt. Lt. HUGH GERALD KEARTLAND, R.A.F., No. 207 Squadron.
Flt. Lt. JOHN CARSON WILSON, R.A.F., No. 6 Squadron.
W/O. THOMAS PHILLIP EDWARD BLATCH, R.A.F.V.R., No. 76 Squadron.
W/O. EDGAR LOUIS GRAHAM HALL, R.A.F., No. 102 Squadron.
W/O. JOHN NEIL PRENDERGRAST, R.A.F., No. 61 Squadron.
W/O. FRANK SANDERS, R.A.F., No. 90 Squadron.

Abbey Service Collection

THE R.A.F. Benevolent Fund has received £252 1s 1d from the collection at Westminster Abbey on Battle of Britain Sunday. Collections for the Fund were taken at Battle of Britain services throughout the country.

Reserve Command Moves

R.A.F. Reserve Command hitherto at Air Ministry, Kingsway, moved to White Waltham, Berks, on October 4th.

R.N.V.R. Air Branch?

PERMANENT R.N.V.R. Divisions authorized before the war are to be reconstituted. The formation of an Air Branch is being considered.

Air Comdre. A. C. H. Sharp

THE Legion of Merit has been awarded to Air Comdre. A. C. H. Sharp, now Director of Accident Prevention, who was Deputy Chief of Staff to the Headquarters of the American Eighth Air Force during 1942-3. Reference is made in the citation to "extraordinary ability to combine frankness with friendship."

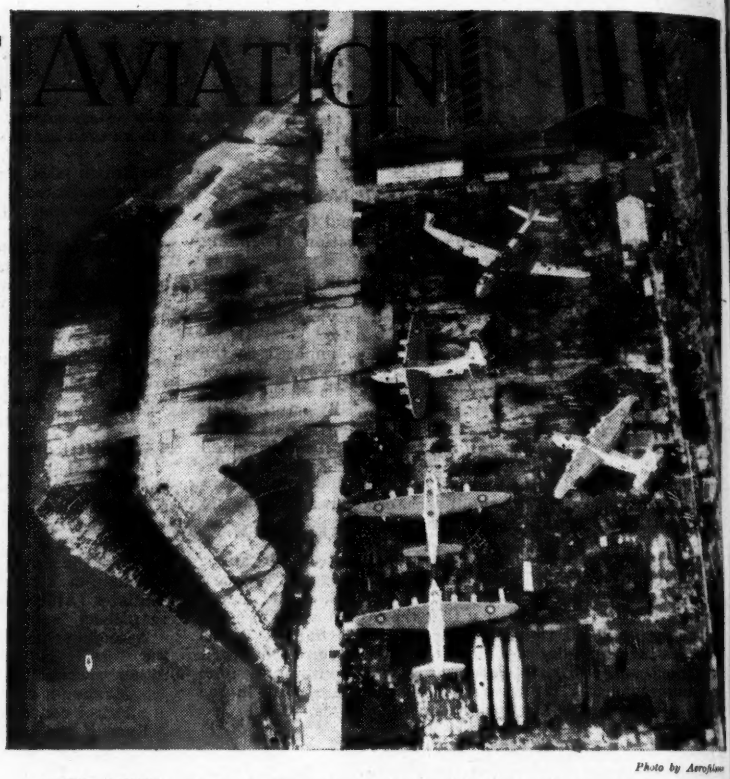


Photo by Aeroplane

RIVER SCENE : Particular interest attaches to this new aerial view of part of the Short factory by the Medway (still known at Rochester as the "Seaplane Works"), showing Seaford flying boats for the R.A.F. in company with the second Shetland prototype.

"Aries" Home Again

THE Lancaster *Aries*, which recently set up the fastest time for the England—New Zealand flight, though this was subsequently bettered by the Lincoln *Excalibur*, returned to Shawbury on October 2nd.

Air Chief Marshal Sir R. Brooke-Popham

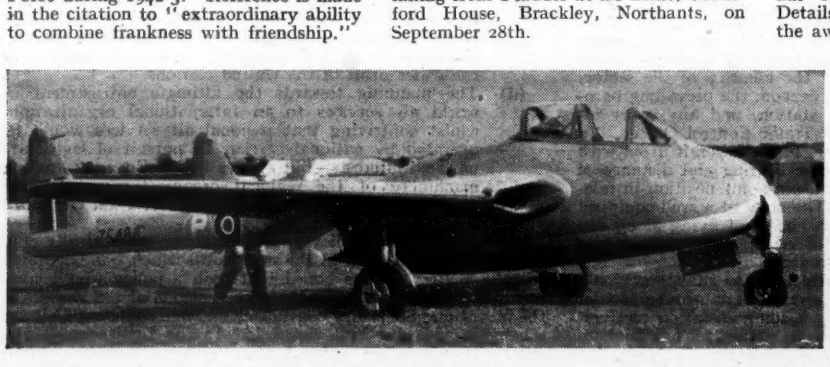
FLIGHT learns with regret that Air Chief Marshal Sir Robert Brooke-Popham is in an Oxford nursing home suffering from six broken ribs and a broken shoulder-blade as a result of falling from a ladder at his home, Cottisford House, Brackley, Northants, on September 28th.

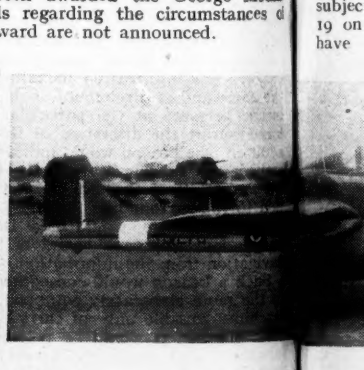
Far East Airfields

THE British Government has decided to spend £20,000,000 in building and reconditioning South-East Asia airfields. More than eight million pounds of this sum has been allocated for airfields on Singapore island. Largest of the new airfields is that at Changi on the western tip of the island. Of comparable size will be that at Butterworth on the mainland opposite Penang Island.

George Medal Awarded

IN recognition of brave conduct whilst a prisoner of war in Japanese hands, F/O. Denis Brian Mason, R.A.F.V.R. has been awarded the George Medal. Details regarding the circumstances of the award are not announced.





VAMPIRE EVOLUTION : On the left is the prototype D.H. Vampire, first flown on September 20th, 1943, by the late Mr. Geoffrey de Havilland. At centre is a Vampire as now used by squadrons of the R.A.F. and on the right a similar aircraft with

Death of Air Marshal Sir B. Sutton

FLIGHT regrets to record the death of Air Marshal Sir Bertine Entwisle Sutton, C.B., D.S.O., M.C., former Air Member for Personnel, at his home at Crookham, Newbury, Berks, on September 29th.

Air Marshal Sutton served in the Royal Flying Corps during the first World War. He was wounded and gained the D.S.O. and M.C. After serving at the Air Ministry he was appointed instructor at the R.A.F. Staff College in 1922, and in 1926 was appointed to command No. 1 Apprentices' Wing at Halton. Three years later he became an instructor at the Imperial Defence College and in 1931, as a Group Captain, he went to India to command No. 1 Group H.Q. On his return to England as Air Commodore, in 1936, he was appointed A.O.C. No. 22 Army Co-operation Group, and in 1937 was promoted Air Vice-Marshal. In August, 1939, he was appointed Air Officer Commanding No. 21 Group and was subsequently Commandant of the R.A.F. Staff College, which post he held until August, 1942, when he was appointed Air Member for Personnel.

Hongkong Casualties

THE Air Ministry regrets to announce that the following casualties occurred in an accident to a Dakota aircraft of Air Command, South East Asia, which crashed at Kowloon Tong soon after taking off from R.A.F. Station Kai Tak, Hongkong, on September 25th, 1946.

CREW KILLED: W/O. A. Christie, R.A.F.; W/O. R. N. Blackmore, R.A.F.; Flt. Sgt. J. K. Hazeldine, R.A.F.; Flt. Sgt. R. S. Bond, R.A.F.; Flt. Sgt. J. W. Holden, R.A.F.

In addition, eight civilian, one Royal Navy, and five Army passengers were killed.

Next of kin of casualties have been informed.

Vacancies for R.A.F. Cadets

THE Air Ministry announces that there will be about 60 vacancies for cadets at the next examination for entry to the R.A.F. College, Cranwell. Successful completion of the Cranwell course provides a permanent commissioned career in the Royal Air Force.

Candidates must be unmarried British subjects between the ages of 17½ and 19 on 1st January, 1947. They must have reached school certificate equivalent. Men already serving are eligible.

The course at the College is free and no fees are payable. Cadets are enlisted and paid as airmen. If successful in their course, which lasts about 2½ years, they will be granted permanent commissions in the General Duties (Flying) Branch of the R.A.F.

Full details and application forms may be obtained from the Secretary, Civil Service Commission, 6, Burlington Gardens, London, W.1. Completed applications must be returned by October 10th.

A written examination will be held in December, with English, General Paper, and Elementary Mathematics and Physics as compulsory subjects, and a choice of two out of 11 other subjects.

Each applicant who qualifies in the written examination will then undergo flying aptitude tests and a medical examination. If successful in these he will be given tests by a Selection Board of the "country house" type at a R.A.F. Selection establishment at Framewood Manor, Fulmer, near Slough, Bucks.

During the course at Cranwell cadets will, in addition to normal flying training, receive educational and general service training to fit them for employment as officers. On graduating, they should have reached the standard of the second year's work for a University Pass Degree and should be qualified as pilots and in navigation, with an understanding of other aircrew duties.

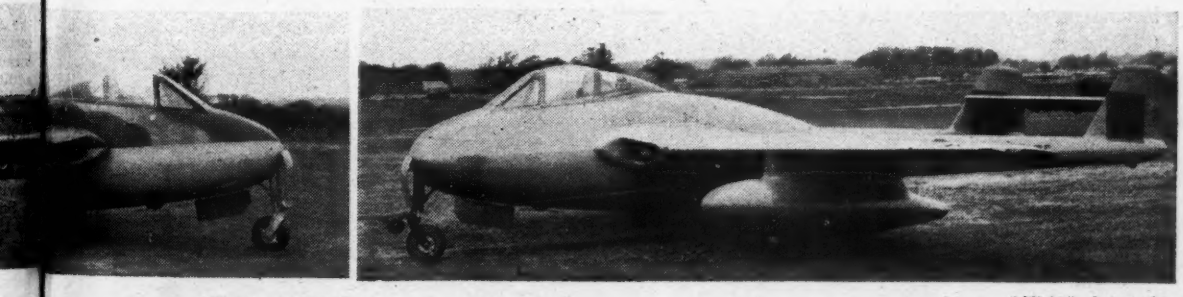
261 Squadron Reunion

IT is proposed to hold a reunion of officers and senior N.C.O.s of No. 261 Squadron, R.A.F. on Saturday, 7th December, 1946, in London. All wishing to attend should contact A. A. Garner, 27, Oval Gardens, Grays, Essex, as soon as possible.

R.A.F. and W.A.A.F. Releases, November and December

ADVANCE notification of the release programme of the R.A.F. and W.A.A.F. for November and December

KING'S MEN: Air Commodore E. H. Fielden, C.B., C.V.O., D.F.C., A.F.C., Captain of the King's Flight, with the crews of two Vickers Vikings, captained by Wing Cdr. E. W. Tacon, D.S.O., D.F.C. and bar, A.F.C., and Sqn. Ldr. H. F. Payne, A.F.C., used as communications aircraft in the Flight.



"Flight" photograph. "Flight" photograph.

Supplementary tankage for the D.H. Goblin radial-flow turbine jet. Without exernal loads the Vampire attains 540 m.p.h. The type is now standard equipment in the Swedish Air Force.

SERVICE AVIATION

has now been made to the Service. The releases to be effected in each of these two months will be officially notified later.

The general level of releases for ground airmen will be Group 47. In a few ground trades, however, airmen in age and service groups up to and including Group 52 will have been released by the end of December. In some trades releases will not have reached the Group 47 mark, but with the exception of two trades all of these will have reached the Group 44 mark.

The general level of releases for airwomen is raised to Group 51. Some trades will not reach this general level but a few will reach 52.

Aircrew, both officers and airmen, will be released up to and including Group 50.

The general level of releases for ground officers of the R.A.F. is Group 47 and for W.A.A.F. officers Group 51.

Some unavoidable variations remain among the groups to be released in employments in which it has not yet been possible to make good current shortages by re-training personnel from other branches and trades.

Decorations by Post

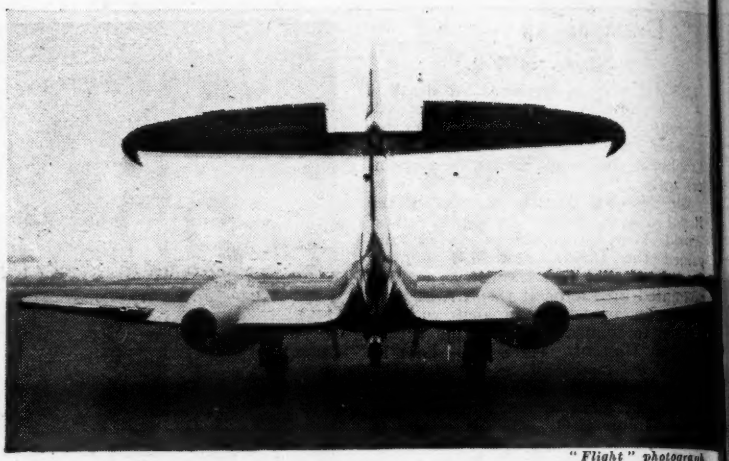
OFFICERS and men winning certain decorations in the field will now receive their medals by post from the King, together with a personal letter.

Largely as a consequence of his own order that all decorations for gallantry should be given by himself at Buckingham Palace, the King has personally presented more than 44,000 decorations since the beginning of the war. There are still 55,000 outstanding awards. His natural desire would be to present all these awards in person, but this he cannot do without interfering unduly with his State business and his public engagements, and without causing excessive delay in the issue of the actual insignia.

His Majesty does not propose to delegate this duty to others, as he regards each award as his personal gift. In future he will confer personally only the following:

Victoria Cross, George Cross, Knights Grand Cross, Knights Commanders, Knights Bachelor, Companions and Commanders of Orders, Distinguished Service Order, Distinguished Conduct Medal, Conspicuous Gallantry Medal, Albert Medal, George Medal, Police and Fire Services Medal for Gallantry and Edward Medal.

The form of application for the issue of decorations must include the following particulars: Name in full (surname first in block capitals); Service number; present rank; rank at date of award; type of decoration; gazette date (if known); address to which delivery by post is desired; date; and signature. The application should be forwarded to The Under-Secretary of State, Air Ministry (S.7(d)), Adastral House, W.C.2.



"Flight" photograph.

CURIOUSER AND CURIOUSER: Photographed in sharp perspective from astern, the Gloster Meteor IV fighter, with its new short-span wing, presents a bizarre appearance, which is accentuated by the raised elevator. All production Meteor IVs will in future have the "clipped" wing.

R.A.F. Education Branch

THE new Education Branch of the Royal Air Force, which replaces the civilian Educational Service that has existed in the R.A.F. since shortly after the end of the 1914-1918 war, came into being on October 1.

Education officers now become part of the Royal Air Force itself instead of being members of a civilian auxiliary service, and the object of the change is to give greater recognition than in the past to the important part taken by education in the training and well-being of the R.A.F.

The Education Branch, consisting of commissioned officers only, is constituted on the same broad lines as other branches of the R.A.F. It is organized on a predominantly short-service basis, provision being made for a percentage of short service officers to be granted permanent commissions.

All permanent members of the existing R.A.F. Educational Service who are medically fit, are recommended by their Air Officers Commanding, and can complete their requisite period of qualifying service for R.A.F. retired pay by the age of 60, will be eligible to be considered for appointment to permanent commissions. In each case qualifying service includes mobilized service in the recent war. Those who do not qualify for appointment to permanent commissions will be eligible to be considered for temporary commissions.

Members of the R.A.F. Educational Service who do not apply for or are not appointed to commissions will continue to serve under their present conditions.

New entrants will be appointed to short-service commissions for a period of 5 years on the active list, followed by 4 years on the reserve, and they will be entered in the rank of flying officer, at an average age of 25, normally after having had some civil teaching experience.

The pay of a short-service officer in the Education Branch approximates closely to the pay of a teacher in civil employment, and, in addition, the married officer will receive a marriage allowance, amounting to about £230 a year. Officers appointed to short-service commissions will, on completion of 5 years on the active list, receive a gratuity, which, for officers appointed until further notice, will be £562 10s. The normal gratuity for five years' service will eventually be £500. Gratuity will be reduced in the case of those whose service is reckonable as contributory service under the Teachers (Superannuation) Acts by the amount of the superannuation contributions payable by the teacher and his employer, both of which will be paid by the Air Ministry. Officers who are appointed to permanent commissions will be eligible for retired pay in the same way as other permanent regular officers. Those who return to civil teaching employment will be able to count their service in the Education Branch for increments in determining their position on the Burnham Scale for pay for civilian teachers.

By bringing to the R.A.F. a regular supply of teachers from civil schools the short service system should be advantageous to the Service.

The badges of (left) No. 7 Bomber Squadron R.A.F. "Per Diem per Noctem" (By day, by night); (centre) No. 210 General Reconnaissance Squadron R.A.F. "Yny Nwyfre yn Hedfan" (Hovering in the heavens); (right) No. 215 Bomber Squadron R.A.F. "Arise, night is at hand."